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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue.

The £30,000,000 Railway Scheme

THE first stage in the procedure for carrying out the agreement between the Government and the four main line railway companies for financing railway improvements up to £26,500,000 was completed on Wednesday evening, when the resolution for this purpose was carried in the House of Commons after debates on Tuesday and Wednesday by 164 votes to 2. Representatives of the opposition freely criticised the resolution but as a body did not divide against it. Mr. Morrison, for the Labour Party, admitted that the proposals would be of public benefit in increasing facilities, but thought the majority of the new works would have been carried out by the companies anyhow. He also objected in principle to Government financing of private undertakings, even though statutory, unless there were some representation by the State on the board of directors, and was afraid that it might lead to a further crop of applications of a similar nature. It was a somewhat fine distinction that he attempted to draw between the proposed resolution and that of last June relating to improvements in the London area, on the ground that the London Passenger Transport Board was a public body. But that board, like the main line railways, has to make money for its stockholders, and the London improvement scheme also included assistance to the London & North Eastern and Great Western Railways. He admitted, moreover, that the risk of the Government being called upon to make good any default on the part of the railway companies was remote. In his reply at the close of the debate the Financial Secretary to the Treasury maintained that the proposed works were all abnormal, and so far from the proposed financial arrangement being intended merely to enable the companies to continue running, they were being conducted efficiently and well at the present time.

* * * *

Donald A. Matheson

As we close for press we learn, with regret, of the death of Mr. Donald A. Matheson, M.Inst.C.E., the last General Manager of the former Caledonian Railway Company, and one of the famous company of engineer general managers of British railways, of whom Sir John Aspinall is now, we believe, the sole survivor. After serving a pupilage as a civil engineer Mr. Matheson was engaged in sundry engineering work, and in turn acted as an engineering assistant on construction of the Edinburgh Suburban Railway, as an engineering assistant on the London & North Western Railway at Manchester, and as contractor's resident engineer and agent on the construction of the Lanarkshire & Ayrshire Railway. He was later engaged for about five years as resident engineer on construction of the Glasgow Central Underground Railway, for the Caledonian Railway, on completion of which he was appointed Divisional Engineer for the Western Division of the Caledonian Railway, and in 1899 he became Engineer-in-Chief, and in 1910 General Manager, holding this office until the end of 1922. On the formation of the L.M.S.R. in 1923 he was appointed its Deputy General Manager for Scotland, but retired at the end of 1926. Amongst the notable works carried out by him as Engineer-in-Chief of the Caledonian Railway was the Glasgow Central station extension, making that station one of the finest in Great Britain. Gleneagles Hotel was also his conception. As General Manager of the Caledonian Railway he enjoyed in large measure the confidence of his directors and of the Scottish public and had an inspiring influence on his staff.

* * * *

The Week's Traffics

Freight train traffics of the four groups in the past week have shown a noteworthy improvement over the results for the corresponding period of last year, merchandise and coal showing improvements of £24,500 and £23,500 respectively, compared with an advance of £16,000 in merchandise and a decrease of £40,000 in coal in 1934. Aggregate merchandise receipts of the main line railways are now £49,603,500, compared with £49,404,500, and coal class receipts, at £28,822,500, show a similarly close correspondence with the figure of £28,690,500 attained at this time last year. Aggregate traffics of the four companies amount to £142,085,000 and are £1,668,000 higher than in 1934. In spite of the lower passenger earnings this week, the aggregates show an improvement of £1,209,000, compared with one of £889,000 in 1934.

	49th Week						Year to date	
	Pass., &c.		Goods, &c.		Coal, &c.	Total	Inc. or Dec.	
	£		£		£	£	£	%
L.M.S.R. ..	3,000	+	21,000	+	14,000	+ 32,000	+ 749,000	+ 1·33
L.N.E.R ..	4,000	−	2,000		—	− 6,000	+ 149,000	+ 0·36
G.W.R... ..	4,000	+	9,000	+	10,000	+ 15,000	+ 221,000	+ 0·94
S.R.	5,000	−	3,500	−	500	+ 1,000	+ 189,000	+ 1·00

Mersey Railway traffics for the year to date are down by £2,390, but those of the Liverpool Overhead have increased by £1,998 in the same period.

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Pullman Car Results

An improvement of £9,765, or 15·64 per cent., in net earnings is shown in the report of the Pullman Car Co. Ltd. for the year ended September 30, 1935, in comparison with the previous year. The total number of passengers was 1,159,847, a small decrease on the previous year, but the gross receipts were up £7,508, or 3·01 per cent., and working expenses were reduced by £2,257, or 1·20 per cent. Cross-Channel air competition continues to affect adversely the company's gross takings from Continental traffic, which were £44,197 for the year under review, as against £73,982 in 1930-31, and £44,195 in 1933-34, and the passengers to and from the Continent numbered only 88,930, as against 92,414 in 1933-34.

	1934-35	1933-34
Gross receipts ..	256,720	249,212
Working expenses ..	184,441	186,798
Net receipts	72,179	62,414
Net income	76,889	66,607

Interest charges have been reduced by £5,100 due to the issue of £100,000 debenture stock which has resulted in the repayment of the balance of the 6 per cent. notes and the reduction of the liability on the electric cars. After providing £38,073 for depreciation, and meeting all charges, and £12,109 for dividend of 2½ per cent. on preference capital on account of arrears, the balance to be carried forward is £26,667, against £15,858 brought in.

* * * *

Ludgate Hill Railway Bridge

At a recent meeting of the City Corporation it was announced that the Southern Railway Company has decided to remove four of the large ornamental brackets from the bridge over Ludgate Hill, and to reduce the width of the bridge by six feet. The Chairman of the Streets Committee said that the alterations would improve the appearance of the bridge. As the scaffolding is already up on the side towards St. Paul's we shall soon see the effect of the alterations. It is a sign of the times that the removal of ornamentation is expected to produce an improvement in appearance, though whether all ornamentation is necessarily ornamental was possibly a matter of opinion even when the bridge was built, for the engineers tried two kinds of elaboration on the outward sides of the bridge. Whether the large brackets were meant to give actual, or only apparent, support to the span over the roadway, or whether they were worked in merely to give a conspicuous position for coats of arms, we do not know. The alterations will do little to open the vista of the Cathedral, but critics may comfort themselves with the thought that there will be six feet less of insult to Sir Christopher Wren.

* * * *

Sighing for the Fourth Class

In October, 1928, the German State Railway introduced the two-class system of second and third on most of its trains, retaining first class only on the principal expresses. Until then there had been a fourth class, providing more standing room than seats, the fares for which were very cheap. From time to time an agitation is heard for the re-introduction of the fourth class, its abolition being unjustly blamed for all the troubles which the railways have since experienced. After the war, the second class lost heavily, whereas before the war it enjoyed a fixed circle of patrons among certain sections of the community, who never used any other class of carriage unless to go first. In addition, the provision of fourth class in the semi-fast trains led to such heavy patronage that third class vehicles, with a mere change of label, had often to be used. The maintenance of so many classes of carriage was costly, so that the abolition of the fourth and lowering of fares in the second was almost inevitable. Unfortunately, there is a lingering impression that the impecunious passenger is being penalised, and this view gained strength when fares were adjusted to meet the crisis. Had four classes been retained, however, train working would have been more complicated and expensive than it now is.

* * * *

Early U.S.A. Railway for Sale

One of the earliest railways in the United States is being offered for sale, according to a recent announcement in the *Railway Age*. This is the Mauch Chunk Railroad, which was built as a 9-mile gravity line in 1827 and of which the *Miners' Journal* of June 4, 1827, said "this novel and interesting work is the lion of the day, and is attracting an uncommon number of visitors from all parts of the country." It was constructed as a private line to bring coal from Summit Hill to the Lehigh river for the Lehigh Coal & Navigation Company, and was apparently a single line at first on which mules hauled back the empty cars. During 1844 the track was doubled and stationary engines replaced the mules. In the words of our contemporary, "steam power lifted cars on the backtrack at Mauch Chunk to Mt. Pisgah, 1,500 ft. up. There they coasted away toward Mt. Jefferson plane, six miles distant. At White Bear, at the foot of the plane, the cars were hoisted again to 1,662 ft. That gave them enough elevation to finish the trip to Summit Hill." The railway was abandoned as a coal route in 1870 and became a tourist and joy-riding line. At one time it carried 50,000 passengers a year without ever having an accident, but the building of a series of road detours near Mauch Chunk destroyed this trade and the railway was abandoned.

* * * *

"Toujours La Politesse"

Japan is at present giving points to railways in other countries as to the best methods of handling passengers, and experiments made recently on the Nagoya Division of the Japanese Government Railways should add considerably to the amenities of travel. For a whole week booking clerks were enjoined, no matter how busy they might be, to reward every purchaser of a ticket with "Thank you very much," and ticket collectors were instructed to give all necessary explanations regarding each traveller's ticket. Most impressive of all, however, were the instructions to platform vendors, who, on the ringing of the starting bell for each train, were bidden to cease their calls, spring to attention, face the train, and lift their caps, remaining thus immobile until the train had started. No information is available as to what happened if the engine was on a dead centre, and this statuesque operation had thus to be prolonged. Another innovation, on the Fuji Express, has been to substitute for the shower bath, which, alas, has not been patronised to the extent anticipated, a barber's shop, on the long through journey between Tokyo and Shimonoseki.

* * * *

Level Crossings at Nantes

By a law passed on June 6, 1934, the French Government approved the plans for the deviation of the Tours-St. Nazaire line where it traverses the city of Nantes, and the use of the two stations by both the Orleans and State Railways. A preliminary loan of fr. 29 million was authorised in January last, and the work has been begun. An agitation extending over forty years has thus attained its object, which was to get rid of the 23 level crossings on the 4¾ km. of the Nantes-St. Nazaire line, opened in 1857, which pass through the centre of the city. Proposals to put the line on a viaduct were strenuously opposed, so in 1912 an avoiding line to the north was

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suggested, and from 1918 to 1923 several schemes were drawn up. Meanwhile, some of the quays at Nantes were showing signs of instability, so it was decided to fill up two of the arms of the river in the city, and use the space for a railway in cuttings and tunnels. The plan included the reconstruction of the Orleans station for all traffic except slow goods, and the concentration of the latter at the State station. A combined marshalling yard at Le Blottereau was also proposed. The cost was estimated at fr. 199 million, but part only of the plan, costing 124 millions, is to be done at first, the money being found by the State, the city, its Chamber of Commerce, and the railways. The level crossings outside the Orleans station will remain for the present, and the line is to tunnel under the city, the new Bourse station being underground.

* * * *

Signal Failures

No apparatus is free from the possibility of failure, and so, in spite of every precaution which good design and careful maintenance can give, we learn from time to time of delays caused by breakdowns of signalling mechanism. These delays are not welcome to the traffic department, which has to take steps to counteract them, nor to the signal department, which is expected to explain and take the blame for them. The rapid discovery and removal of defects is a matter not only of organisation, but of education of the maintenance staff, for the ability to find out what is wrong with a piece of apparatus is the product of a certain natural aptitude, which some men certainly seem to possess more than others, and of training derived from experience. A valuable complement to personal experience is that gained by studying the problems faced and solved by others. An analysis of failures and the steps taken to deal with them, both at the moment and then, if necessary, by the adoption of improved designs to meet the trouble, is a fascinating study, and one which deserves more publicity than it has hitherto received. There must be a great deal of information waiting to be collected and co-ordinated which would be extraordinarily helpful to the maintenance staffs. We wish someone would write a good paper on the subject, for it would certainly be well received.

* * * *

Containers in Sweden

According to the *Nordisk Järnbanetidskrift* the use of containers for parcels traffic has met with considerable success on the Swedish State Railways, although their use for heavier door-to-door traffic has so far been very restricted owing to unfavourable conditions. At present there are 42 containers in use, 10 for traffic from Stockholm North and South to the Lottefors-Ljusdal-Alby line, enabling time to be saved at Hudiksvall, where parcels would otherwise have to be transhipped. The remaining 32 are in service from Stockholm North on the lines to Kiruna, Gällivare, Malmberget, Koskullskulle, and Luleå. The traffic to Luleå and Kiruna often requires two containers, necessitating the running of five daily on that route. They are loaded in Stockholm into the same van that formerly served all stations, the Stockholm-Boden transfer van, and are transferred at the latter station into the one going to Luleå. The saving of time has greatly simplified the work at the junction stations. A reduction in the number of vans running in this service has also been made, leading to a further saving. The containers are all of Swedish make and afford about 3 cu. m. space (3·92 cu. yd.), sufficient on the average for 1,000 kg. (approx. 19 cwt.) goods. The tare weight is 300 kg. (5 cwt. 3 qrs.). The sides are removable in planks, making loading and unloading very simple. Wheels are provided, those at one end swivelling like castors, and there are also adjustable feet which can be dropped to lift the body off the ground, and off its wheels also for stability.

* * * *

Roller-Bearing Rods

Although roller bearings for locomotive driving axleboxes are increasing in number, there are still very few applications to connecting and coupling rods, because of restricted space, initial expense, and the difficulty of combining the close tolerances needed for roller bearings with the flexibility required for the rods. Among the installations are S.K.F. bearings to the rods of a 4-8-2 tank engine of the Randfontein gold mine, and to those of a high-pressure Pacific of the Delaware & Hudson Railroad. Timken bearings have been fitted to the rods and to the gudgeon pins of one of the Pennsylvania Railroad Pacifics, but before these taper bearings could be applied an entirely new set of rods, crossheads and pistons had to be made, and when doing this an opportunity was taken to lighten the sections and use a nickel-chrome-molybdenum steel with a yield point of 53 tons. The bearings are fitted on to the crankpins and not into the rods, and to get a satisfactory design for the coupling rod ends it was necessary to use separate rods for the front and back portions in place of the more usual forked arrangement. The outer race of the big-end bearing is extended along the crankpin and takes the bearings of the two coupling rods, so that the driving crankpin itself is subject only to the load transmitted to the driving axle. Following experiences with roller bearings for driving axleboxes, the stress concentrations in the axle frequently found with this type of bearing have been carefully studied, and in the 100,000 miles which this Pacific has run since the installation of roller bearings, no similar trouble in the crankpins has come to light.

* * * *

Forecasting Engines for Heavy Repairs

The paper entitled "Forecasting Engines for Heavy Repairs," read by Mr. S. T. Willcox before a meeting of the Indian Centre of the Institution of Locomotive Engineers (Southern Area), was followed by a very interesting discussion which is reported in the latest issue of the journal of the institution. The question of what was an economical mileage between repairs was shown to be very debatable. It is generally agreed that the decisive influence upon engine mileage is the condition of the axleboxes. In the course of heavy repairs, brasses are sometimes renewed before the material reaches the final condemning stage, and it is desirable to settle once and for all what is the economical mileage that should be achieved before repairs of this class are carried out. One of the speakers asked whether cases came within the author's experience where the boiler shop foreman's opinion differed from that of the boiler inspector regarding the repairs required on a boiler, and also whether the boiler shop foreman ever found that the boilers required a heavier repair than was at first anticipated from the inspector's report. The author replied that the system described in his paper took account of such discrepancies by being based on the law of averages. Once it was found that a series of boilers required heavier repairs than were laid down in the inspector's report, then the stores' stock automatically adjusted itself to meet that increased demand, and he thought that from the point of view of stores' stock it would not be affected by the difference of opinion between the foreman and the boiler shop inspector.

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The German Railways Today

WHEN, at the celebration of the Reichsbahn centenary at Nuremberg last Sunday, Dr. Dorpmüller, the General Manager, described the development of the German railway system during the past 100 years, he referred to the remarkable economies, totalling about £2,000,000, which had been effected during the past decade as a result of the introduction of modern methods. No observant visitor to Germany today can fail to be impressed by the high degree of efficiency with which that great organisation is conducted. Probably the most impressive feature is the almost complete absence of out-of-date equipment, and the traveller coming from most of the neighbouring countries is at once struck with this feature. It is not merely that much of the equipment is new; an important contribution to the result is that what is not new is well maintained, and in many instances has been thoroughly modernised. The visitor will experience the efficiency of the German railways in his travels. He will find that the passenger train services have been greatly accelerated of recent years, but that their punctuality has not been impaired thereby. It is rare to experience delays on the way, but when a train is late, a circumstance due chiefly to frontier delays, much if not all of the time is usually made up before the destination is reached. German trains have long had the reputation of cleanliness and, at least in the first and second classes, comfort, a reputation well maintained today. Third class, as on most Continental railways, is cheaper than anything in this country, except special excursions, but the accommodation is of a more Spartan type. Most of the principal expresses are equipped with restaurant cars, and those that travel by night with sleeping cars. In the former, not only *table d'hote* but *à la carte* meals can be obtained, and in the latter light refreshments also are always available. All sleeping car trains provide first and second class accommodation, and some third class also. A notable development, inaugurated in the spring of 1933 with the Flying Hamburger, is the high speed connections provided by fast diesel trains between provincial towns and the capital, so arranged as to give the visitor from noon till nightfall in the city, and yet to return him whence he came the same day. These services are not all yet in operation, but, as the necessary railcars are delivered, they are being steadily increased in number. Already Hamburg, Cologne, Frankfort and Munich have their high speed diesel services averaging over long distances upwards of 70 m.p.h. It is on one of these runs that the present fastest start-to-stop speed in the world is accomplished, namely, from Berlin to Hanover, 157·7 miles, at an average of 82·3 m.p.h.

It is not only the passenger who fares well on the German railways, his goods are also punctually and quickly transported. Goods trains are now all continuously braked, a development that has made possible the raising of their average speeds to a high level. Intermediate stops have been reduced in number by the institution of fast light pick-up goods trains, some of them operated by diesel vans. The diesel has indeed found wide application in many spheres on the German railways, not only for these goods trains and for the high speed passenger services already mentioned, but for shunting and, in the form of railcars, for local and semi-fast services. Electrification has already been greatly extended in the last few years, and an ambitious programme is now in course of execution. The Berlin suburban railways are now practically all electrically operated on the multiple-unit system, as also are the local services round Hamburg, Munich, and Stuttgart. Both local and main line trains are operated by electric locomotives on some of the Silesian and Central German lines, as well as on the main Bavarian lines between Salzburg, Munich and Stuttgart, and Munich and Nuremburg. The main trunk line north from Nuremburg to Leipzig and Halle is now in course of electrification, and with the completion of the remaining 100 miles to Berlin within the next year or two, main line trains will be electrically hauled from the metropolis to the Austrian frontier at Salzburg, a distance of over 500 miles. The 15,000-volt single-phase system, standard in Germany for main line work, is that adopted. With all this progress in diesel and electric traction, the steam engine has not been neglected, and the latest standard types are as efficient in operation as any to be found elsewhere in the world. Based upon service tests the claim has been made that an overall thermal efficiency as high as 10 per cent. is achieved by the latest compound locomotives working at the high pressure of 355 lb. per sq. in. The Reichsbahn has also claimed the highest speed so far achieved by a steam locomotive, namely, 119 m.p.h. by a streamlined 4-6-4 locomotive on the Berlin-Hamburg line.

With the development of faster and consequently heavier moving loads the civil engineering departments have kept pace by standardising a type of permanent way well up to present and future requirements. Flat bottomed rails weighing 98 lb. per yd., and secured to substantial soleplates independently of the fixing of the latter to the sleepers, provide a track which incorporates the virtues of the British standard bull-headed type without the latter's disadvantages. Ample drainage and ballast is a feature of the German permanent way; and although in initial cost it may be expensive, there can be little doubt that the reduction in maintenance charges is sufficient to justify this. Certain it is that a remarkably smooth running track is provided for any traffic placed upon it. Thirty-metre (98-ft. 5-in.) rails have been standard for some years in Germany, and experimental lengths are in existence of rails welded to 60, 75, and even 125-m. lengths, all of which appear to have given complete satisfaction. Signalling also has been highly developed and, where necessary, modified to enable the new fast schedules to be operated with safety. Most of the main lines have been, or are in course of being, equipped with automatic train control, the induction type being generally favoured. An important contribution to safety as well as punctuality is made by the almost universal provision of flying junctions. Structural engineering shows the influence of the development of welding. Numerous station roofs display this feature, and there are now no fewer than 100 railway underbridges of welded construction. It must be pointed out, however, that conditions on the German railways are scarcely comparable with those encountered on the railways of this country. Normally the traffic density is considerably less, and the long custom of the German people to organisation and the orderly conduct of everyday movements facilitates the high degree of efficiency generally to be found on the railways of that country today.

* * * *

Research on the L.M.S.

DURING the nineteenth century each of the principal British railway companies established laboratories for the control of purchased and manufactured products, the earliest example being that of the L.N.W.R. at Crewe opened in 1854. In the early days they were not regarded as research laboratories, although now and again the pioneer enquiries of individuals resulted in sustained investigations. Similarly in other departments of the railways such investigations were sometimes carried out by

those officers who were not content with routine trials of new materials and methods. After the railway amalgamations in 1923 the need began to be felt for a more definite research policy not only to co-ordinate investigations by railway officers, but also to study and apply to railway problems the results of scientific advances made by research workers in outside institutions. In 1928 Sir Josiah Stamp set up on the London Midland & Scottish Railway a small committee, under the late Mr. R. W. Reid, to report on the need for more intensive scientific research on that railway, which is the largest commercial undertaking in the world and on which therefore it was most appropriate that a comprehensive programme of research should first be undertaken. This committee recommended the appointment of a Director of Research and of a permanent advisory committee to assist him, but did not suggest immediate expenditure on new laboratories.

In 1930 Sir Harold Hartley was appointed Vice-President and Director of Scientific Research of the L.M.S.R., and an advisory committee, consisting of a number of distinguished scientists and the chief technical officers of the company, was set up. The various laboratories were still under departmental control until 1931, when the chemical, paint, and mechanical testing laboratories were placed under the supervision of Sir Henry Fowler. He retired in 1932, and the chemical, paint, metallurgical, and textile laboratories, together with the nucleus of an engineering section was formed into an independent Research Department, the present manager of which is Mr. T. M. Herbert. This organisation exists today, and the effect of the completion of the new laboratory at Derby which, as we record elsewhere in this issue, was opened last Tuesday by Lord Rutherford, will be to concentrate in one building the paint, metallurgical, textile, and engineering sections. The chemical section has of necessity to maintain laboratories at a number of centres to deal with divisional and local work, but perhaps the best equipped of these chemical laboratories is that already existing in Derby not far from the new building. The new laboratory thus effects a concentration of scientific resources, and greatly increases the facilities for research, but it has never been the policy of the L.M.S.R. to render its research organisation independent of outside scientific assistance. The problems which may arise in the varied activities of a railway are so diverse in character that a very large staff of specialists would be required to deal effectively with all of them. The department, therefore, utilises to the fullest extent the national research organisation established under the Department of Scientific and Industrial Research; the company is a member of six research associations; whilst, in addition, certain problems are allocated to the research laboratories at the universities.

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South Australian Government Railways

OPERATING results for the year ended June 30, 1935, show a reduction of £46,246 in the deficit as compared with the previous year. This improvement is due to the increase of £98,638 in earnings—largely the result of the wheat carry-over from the previous year, and a reduction of £61,348 in the interest bill. Sinking fund, depreciation charges, and pensions, however, required more, and additional payments for wage restorations cost £69,000. The surplus of earnings over working expenses gave a return of 1·5 per cent. on capital, as compared with 1·8 per cent. for the previous year. Mr. C. B. Anderson, Railways Commissioner, again calls attention to the fact that the railways are called upon to pay interest on the capital cost, estimated at £10,800,000, of developmental lines which, as railways, are not commercial propositions, though they have brought in large revenues to the State in other ways. Results are compared in the accompanying table:—

	1934-35	1933-34
Miles open	2,529¼	2,529¼
Train-miles	5,080,319	4,930,271
Rail passenger journeys	16,660,213	16,325,004
Paying rail-borne freight, tons	2,332,581	2,141,646
Average haul, miles	119·79	123·32
Operating ratio, per cent.	79·8	79·2
	£	£
Capital cost of open lines	27,898,092	27,779,196
Gross earnings	2,669,470	2,570,837
Expenses (including pensions)	2,129,791	2,036,110
Surplus	539,679	534,727
Interest, sinking fund, and exchange	1,334,144	1,375,438
Total deficit	794,465	840,711

Railway passenger receipts amounted to £524,884, an increase of £8,631, and railway freight receipts (goods, minerals, and livestock) advanced from £1,762,899 to £1,853,188. Road motor services brought in from passengers £803 against £1,012, from parcels and mails £3,938 against £3,958, and from freight £6,164 against £5,853. There was an increase of 178,030 tons in the quantity of wheat railed, and also an increase in steam passenger train miles as a result of traffic arising from the visit of the Duke of Gloucester, but there was a saving in rail motor miles due to re-arrangement of services. Freight train mileage increased because of the greater tonnage of wheat and minerals. Refreshment room and dining car services, bookstalls, and other subsidiary services brought in a profit of £8,827. A revision of the freight and livestock rates book came into operation as from April 1, 1934. Reference is made in the report to the satisfactory experiments with diesel railcars and to the intention to construct a diesel shunting locomotive. Control of traffic on the controlled routes established by the Transport Control Board has enabled the railways to regain a portion of the business lost through indiscriminate road competition.

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Charles Sydney Page

WITH the retirement at the end of the year of Mr. Charles Sydney Page, the railway world is losing an outstanding personality and one whose active co-operation will be widely missed. Beginning his career—which we briefly outline on page 1023 on the former North Eastern Railway, he quickly rose to prominence in both railway and dock spheres, so that, 15 years ago, he was selected for an appointment at Cardiff that soon led to his becoming Chief Docks Manager of the Great Western Railway. His appointment to this responsible post coincided with the beginning of the general strike, so that a somewhat anxious time followed immediately on his taking up control of the Great Western Company's docks. It was naturally all-important that the entrance of ships to and exit from the company's docks should continue without interruption, and that, so far as possible, these vessels should be loaded and unloaded. Mr. Page by his personality and example proved a great inspiring force for the voluntary workers and those members of the staff who remained loyal to the company, with the result that no vessel was refused admission or failed to sail when it was in a position to do so. After the general strike had collapsed, it will be remembered that the coal strike continued for many months. While this naturally affected docks trade and revenue, yet the company's docks proved a most useful avenue for the importation of coal, by means of which its locomotives were driven during that uncomfortable period. During all that anxious time Mr. Page acted as Chairman

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of the local Coal Shipment (Emergency) Committee, a committee set up by the Government to control and conserve the supplies of coal in stock for bona fide national purposes; this committee functioned during the whole of the seven months that the coal stoppage continued.

Mr. Page has often had to give evidence for the Great Western Railway Company in the law courts and before committees of the Houses of Parliament. His judicial qualities have also been recognised in connection with labour matters, and he has been associated on a number of occasions as the employers' representative, with trade union leaders, notably Mr. Ernest Bevin, as joint arbitrator in connection with questions arising out of port labour matters. Mr. Page has, moreover, won the esteem and confidence of the trading community in South Wales, and this has been exemplified by the fact that the various chambers of commerce and principal trading associations in the district joined in a function of farewell and good wishes, taking the form of a banquet and presentation to Mr. Page at Cardiff on December 9. In his younger days Mr. Page found his recreation in swimming and rowing, and spent many a day on the River Ouse. He is a keen lover of the open country, and for many years made it an invariable habit to walk from twenty to thirty miles every Sunday. Of more recent years he has continued his fondness for exercise and covers much the same amount of ground as formerly, but under the fascination of following the little white golf ball. With a Yorkshireman's bluffness, Mr. Page is outspoken, and has never minced his words when dealing with the traders or with the staff. Nevertheless, he has an outstanding gift of inspiring loyalty and affection to those with whom he has been closely associated. Mr. Page has been the recipient of presentations from his officers and his office staff, and has received expressions of good will on his retirement from very many other quarters. He is to live once again in his native county, having taken a residence near Harrogate, and we join his host of friends and admirers in wishing him a long and happy retirement.

* * * *

Modern Developments in Signalling

THE paper with the above title, by Major Peter, which was read at the Institution of Electrical Engineers on Thursday of last week, might be regarded as supplementary to our article, "Twenty-Five Years of Railway Signalling," in THE RAILWAY GAZETTE of October 11. All the subjects named in the present paper were covered by our article, but we contented ourselves with recording that certain things were done in a given year. We gave no details, and it is in these that Major Peter's paper may be regarded as supplementing our own remarks. Major Peter found that there were two periods to be covered—the post-war, from 1918 to the grouping of the railways in 1923, and the post-grouping, from 1923 to the present day. It is his opinion that to have excluded the earlier period would have removed the foundation of some of the later developments. As a reference to our article would show, the omission of the events prior to grouping would have failed to credit the earlier period with, for instance, the introduction of one of the most successful of economies in operation secured by signalling—the long-distance operation of facing points. In the interval between the end of the war and the grouping of the railways, there was also the introduction of colour-light signals and the improved methods of working single lines that permitted of the conversion of double lines to single, with its economies in track maintenance, in the manning of signal-boxes and —a surprising feature—better operating results. In the later period there have been many developments that were never anticipated by the older signalling and operating officers, but which no longer appear remarkable to the present generation.

One of the most striking contrasts with former days was the introduction of electrical actuation, in 1929, of interlocking between the individual levers in a frame, instead of the ninety-year old mechanical methods. The next most outstanding event is the operation, by long-distance point mechanism, of facing points at unusually great distances, as at Inny Junction in County Longford, where such points are 3¼ miles away; also the provision of intermediate block section signals that, similarly, protect a section that is over three miles from the signal-box. Centralised traffic control and, later, the control panel locking frame, which are, in effect, a development of long-distance point control, are other outstanding features of the post-grouping period. Axle counting, the first attempts at which were made over 30 years ago, now gives promise of much usefulness in the near future, having already rendered a certain amount, especially on the Continent. All these, and other features that we have not mentioned, were described in detail by Major Peter, whose present contribution following on much previous excellent work of a similar character, renders valuable service to the institution he was addressing, to the kindred body of railway signal engineers, and to signalling and operating officers generally. To this compliment we feel impelled to add that, for most of these advances in signalling, the railways are indebted, often for their origin and always for their development, to the signal manufacturing firms.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Accident Reports

Ferrocarril Taltal,
Chile. October 31

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—In enclosing my subscription may I say that in adding my congratulations to the great number you have received from all parts of the world on your centenary, I can imagine how encouraging, also how pleasant it must have been to you and your editorial staff to have received such generous commendation and praise.

I do not remember any mention having been made by any of your correspondents respecting the accident reports which from an administrative, as well as a departmental point of view I consider of paramount importance, especially the recommendations of the Government Inspectors, because a careful perusal of these reports must of necessity assist in pointing out questionable or faulty working, the danger of which is very often not readily appreciated, probably due to the fact of it having become more or less a general practice. A case in point was the Cambrian head-on collision about 14 years ago when I considered it necessary to direct the attention of the stationmasters against signing beforehand and in blank the *via libres*, *i.e.*, starting orders, thus affording the opportunity for them to be filled in later by unauthorised persons, such as learner clerks. Another instance which I particularly remember was an accident which occurred in India many years ago when a pilgrim special jumped the points at a crossing and crashed into another train resulting in a heavy loss of life. Strange to say a long time after when I arrived in Taltal my attention was immediately drawn to an almost customary practice of shunting back an up passenger train at a siding about 50 km. from the port to allow a down nitrate train to pass. It is not difficult to imagine the consequences if the nitrate train weighing 400 tons, coasting down on a 2 per cent. grade, jumped the facing points with a passenger train standing 30 metres distant. Yours, etc.,

T. COULSON THOMPSON
Traffic Manager

PUBLICATIONS RECEIVED

Northampton Vindicated. By Joan Wake. Northampton : 39, Collingwood Road. 8¾ in. × 5¾ in. 32 pp. Price 2s. 0d.—In the early days of railway promotion, it is well known that certain towns opposed the construction of lines within their borders. A much quoted example has been that of Northampton, and until the production of the present brochure few railway historians would have queried the accuracy of so doing. Miss Joan Wake, who is the Honorary Secretary of the Northamptonshire Record Society, thought it worth while, however, to go in some detail into the question which had brought the town into such unenviable prominence, and the result of her investigation is shown in this little work. As the title indicates, it is as complete a vindication as is possible in view of the sparseness of records and the known difficulty of "proving the negative." It is a fascinating story, well documented, and with two appendices, one setting out the appropriate quotations from works mentioning Northampton's opposition to the railway, and the other listing early works on the London & Birmingham Railway Company which do not make any such mention. Miss Wake concludes that there was never persistent opposition from Northampton through its official local government, and that pronounced favour was shown by a committee of inhabitants. She traces the origin of the story to the well-known book by Thomas Roscoe, issued about 1839, and shows that subsequent writers have quoted him without troubling to verify the details. This brochure is a notable though small contribution to early railway history, and is all the more unusual in that it is the first work of its kind which we can recall to have come from the pen of a lady author.

Final Report on the Fourth Census of Production of the United Kingdom (1930). Part V. London : H.M. Stationery Office, Adastral House, Kingsway, W.C.2. 175 pp. 9 in. × 6 in. Price 3s. net.—This is a general report which summarises the statistics contained in the four previous volumes of the Fourth Census of Production (for 1930), and shows that the net output was about 10 per cent. less than in 1924. The volume of total industrial production in 1930 was, however, about 8½ per cent. greater than in 1924. The net output per person employed decreased from £2 12s. 2d. in 1924 to £2 10s. 8d. in 1930. The gross output for the total of 49,499 establishments in the category of factory trades was £2,652,008,000 and the net output £1,048,087,000, the cost of materials involved being £1,511,848,000. The average number of persons employed, excluding outworkers, was 4,750,168. There were, in addition to the establishments covered by these figures, about 160,000 small firms employing on an average fewer than 11 persons. Goods imported and subjected to manufacturing processes in this country in 1924 were valued at £666,000,000, against £483,000,000 for 1930. Exports of produce and manufactures were valued at £801,000,000 in 1924, against £571,000,000 in 1930.

Report on the Import Duties Act Inquiry (1933). Part I. London : H.M. Stationery Office. 9½ in. × 6 in. 329 pp. Price 5s. net.—This section of the report deals with the textile, leather and clothing, food, and chemical and allied trades, with a final chapter on miscellaneous trades, such as rubber, coke and by-products, incandescent mantles, and fancy articles. The inquiry upon which the data are based was instituted in accordance with Section 9 of the Import Duties Act, 1932, which empowered the Board of Trade to require occupiers or managers of factories or workshops engaged in producing goods in this country which would be dutiable if imported, to furnish the following information : quantity and value of output ; quantity and cost of materials used ; quantity and cost of fuel and electricity consumed ; number of persons employed. The returns tabulated in the present report relate to the year 1933, and have been supplied only by establishments employing an average of ten or more persons in that year. Comparisons with the results of the Census of Production held in 1930, the final report on which is reviewed above, are shown throughout. An alphabetical index is given to the tables of output data for the trades covered by this section of the report.

Winter Sunshine.—Winter sunshine on the Continent and in North Africa, accessible by land, sea, or air, is the theme of a handbook with the above title, and a special pleasure cruise folder, received from Thos. Cook & Son Ltd., Berkeley Street, W.1. Rates including transport are now quoted for visits to Algerian and Tunisian resorts, as well as those in Europe. Holidays are planned for those wishing to indulge in winter sports, or Christmas and New Year festivities on the Riviera, as well as for those who are specifically seeking more restful forms of entertainment. The pleasure cruise folder gives a chronological list of sailings for the whole of 1936.

Winter Sports in Many Lands.—Several unusual centres for winter sports are described in this illustrated handbook from Thomas Cook & Son Ltd., Berkeley Street, W.1, among which may be mentioned Czechoslovakia and Poland. Those who have time for a journey overseas will be interested in the possibilities of Canada, while winter sports during what are the summer months in Europe may be enjoyed in Australia and New Zealand. Since 1927, ski-ing, skating, tobogganning and ski-jöring have been developed in Kashmir, at Gulmarg, and there are good conditions for such sports in the Lebanon (Syria). European countries (other than Switzerland, which is treated in a separate handbook) are represented by France, Italy, Austria, Germany, and Scandinavia.

Winter Sports.—The winter sports programme of the National Union of Students, 3, Endsleigh Street, W.C.1, covers holidays at remarkably low rates in Austria, Germany, and Switzerland, and includes tours on ski for the more advanced exponents as well as periods at training centres for those in their novitiate. The arrangements are made for the benefit of students of the universities and university colleges of England and Wales.

Tests of Timber.—The Department of Scientific and Industrial Research, 16, Old Queen Street, S.W.1, has issued two reports on the work carried out at the Forest Products Research Laboratory. They are numbers one and two of a series of Forest Products Research Records, approximately ten of which, at a uniform price of sixpence, will be issued a year. Record No. 1 deals generally with the testing of timbers at the laboratory, and No. 2 is the first part of a series on strength tests of structural timbers.

Permanent Way Maintenance by Welding.—Murex Welding Processes Limited, of Ferry Lane Works, Forest Road, Walthamstow, E.17, has issued an illustrated booklet dealing with the maintenance of permanent way by electric arc welding. The equipment described consists of a Murex patent dynamo rated at 6 kW., driven by a 12-h.p. diesel engine. A 200-V. auxiliary dynamo is provided for driving the 2½-h.p. grinding motor, or other standard electric tools, while welding is in progress. With this set any size of electrode up to No. 4 S.W.G. can be used. The size of the plant is such that it can be placed in the six-foot way. The booklet gives instructions, with diagrams, for reconditioning crossings, and also illustrates a special two-operator set for bridge repairs.

Mixed Pressure Steam Turbines.—Utilisation of low-pressure exhaust steam for driving turbo-generator sets is a feature of the mixed-pressure steam turbines described in a new illustrated catalogue published by the English Electric Co. Ltd., of Queen's House, Kingsway, W.C.2. As well as working from a mixed-pressure supply, these machines will run with high efficiency on high- or low-pressure steam, and their speed does not vary when changing from either power source to the other. This operation is effected automatically by a combined pressure- and centrifugally-operated governor, which takes immediate advantage of any available quantity of low-pressure steam. A concluding pictorial section of the catalogue illustrates generator sets powered by mixed-pressure turbines as installed by various large industrial concerns.

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THE SCRAP HEAP

Josef von Baader: German Railway Pioneer

The names of Harkort and List, the railway pioneers referred to in our issues for July 19 and 26, respectively, are comparatively well known, but that of von Baader, who died 100 years ago on November 20, is little referred to, although he had a good deal to do with the development of the railway idea in Germany. Unfortunately, he did not live to see the opening of the Nuremberg-Fürth line, which took place on December 7, 1835, a fortnight or so after his death. We reproduce some interesting details concerning his life from the columns of the *Journal of the Central European Railway Association*.

Josef Baader—afterwards knighted and becoming Ritter von Baader—was born at Munich on September 30, 1763, and studied medicine at Ingolstadt, Vienna, and Göttingen; then in London and Edinburgh in 1786. The advanced state (for the time) of certain technical processes in industry so attracted him that he abandoned the study of medicine and turned enthusiastically to mechanics. Returning to the Continent, he interested himself in mining in the Harz district and Bohemia in 1790. At the request of the Elector of Bavaria he came to England again in 1791, and from 1794 to 1832 was engaged in Munich, directing mining of different kinds. He also joined the Bavarian Academy of Science and gave lectures on mechanics at the University. He was responsible for some inventions concerning pumps and fire engines, but they were not very successful.

Baader was undoubtedly the first person in Bavaria to see the significance of the principle of traction on smooth rails, then being turned to successful account in England, and he endeavoured by speech and writing to persuade his contemporaries to adopt it. He actually took out the first patent granted in Germany for a form of railway construction, which he exhibited in model form to the King in 1814. He wrote an article for an historical journal in 1817 proposing a narrow gauge horse railway line connecting Donauwörth with Kissingen via Nuremberg, to stimulate goods traffic between the Danube and the Rhine.

In 1818 Baader exhibited another trial vehicle to the royal family, and persuaded a member of the Diet to raise the question of using his form of construction for a line from Nuremberg to Fürth. In 1822 he published a work entitled "A New System of Mechanical Propulsion," which attracted much attention. In 1826 he laid a piece of track on his system at Nymphenburg, and dealt with the question in an official academic discourse. His ideas were not taken up, however, because the success of the arrangements adopted on the Stockton & Darlington line became known, and many favoured copying the English form of construction, while Baader fell into disfavour with the Regent of Bavaria because he opposed the latter's plans for a system of canals.

In 1828 Baader published a pamphlet setting forth the superiority of railways to canals, and in 1831 he came forward with an idea for a compressed air locomotive, and a proposal for a railway from Munich to Starnberg, with a steamer service on the Würmsee. After that, he gradually fell from public esteem, for which it is said his somewhat inconsistent character and tendency to boast were largely responsible. When Johannes Scharrer consulted him in 1833 over the building of the Nuremberg-Fürth line, he unsuccessfully tried to persuade Scharrer to adopt his designs, saying the English form of construction was too costly. Fortunately for Germany's first railway, the best which English experience could suggest was used, which must be counted the chief reason why the little line did so well from the start.

One Hundred Years Ago

Extracts from the December, 1835, issue of "The Railway Magazine" (afterwards "Herapath's Railway Journal") and the oldest constituent of THE RAILWAY GAZETTE

It may not perhaps be generally known that railroads are governed by nearly the same regulations as turnpike-roads. They are not confined to the traffic carried on by the company only; but any party may start a locomotive engine, with trains of carriages for passengers or goods, subject to such regulations as are fixed on by the Act, and likewise to certain tolls, the maximum of which is also determined. The directors of a company are empowered to enter into agreement or contract with another company to permit carriages to pass over their line for a sum below this maximum; but they must not exceed it.

GREAT NORTHERN RAILWAY.—As there can be no doubt that travellers from Northumberland, and the whole of Scotland, must ultimately travel to London by a railway on the *east* side of the island, the west side being impracticable for a railway into Scotland, it is now under contemplation to carry the North Midland Railway northward to Newcastle, and ultimately to Edinburgh. There is, however, a difference as to the line by which the railway should pass through the centre of Yorkshire. The inhabitants of Leeds, and the Committee of the North Midland Railway, are anxious that it should pass through Leeds, whereas the inhabitants of York are anxious that it should pass through that city.

LEEDS & MANCHESTER RAILWAY.—The sum required for the construction of this railway is £800,000, but the shares already subscribed for amount to £2,300,000.

M'CUNDY LINE OF BRIGHTON RAILWAY.—A prospectus of this line of railway has been issued, by which we perceive that Colonel Landmann, of the Greenwich Railway, has been appointed engineer, and Mr. Herapath, assistant-engineer. This line, we understand, possesses a peculiar and important advantage over others; it will require *no tunnels*, the loss of life from which has been so great as ought to make persons pause before they engage in lines where such are indispensable.

Among the numerous railway announcements in all quarters of the United Kingdom it is curious to mark that, so far back as the year 1822, when the value of this mode of conveyance was comparatively little known to the public, Sir John Sinclair, in the course of his agricultural pursuits, conceived the idea of a railway between the two British capitals, and at that period obtained a professional report on the practicability of the subject from Mr. Robert Stephenson, of Edinburgh, civil engineer.

THE BRISTOL & EXETER RAILWAY.—A railway is projected from Bristol to Exeter, in conjunction with the Great Western, by which, when completed, goods and passengers may be brought direct from London to Exeter, and from thence, if another were formed from the latter place to meet the Dartmoor Railway, on to Plymouth and Devenport.—*Devonport Telegraph.*

DUMFERLINE RAILWAY.—Several of the manufacturers and other public-spirited individuals connected with Dumferline, and interested in its prosperity have lately projected another railway to the coast, to join the sea at St. Margaret's Hope, the beautiful and sheltered bay near the ferry. It is thought that the expense might be lessened by joining Sir Philip Durham's Railroad, in which case a junction would be effected between Dumferline and Inverkeithing. — *Edinburgh Observer.*

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OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

ARGENTINA

The Level Crossing Danger

October was more than usually prolific in road motor accidents, including several at level crossings, in which some loss of life was involved. In nearly every instance, the cause was the carelessness of the drivers of the road vehicles. The most serious of these mishaps occurred on the B.A. Western Railway near Carlos Maria Naon station, on the branch line from Bragado to Timote, when a micro-omnibus was run into by an excursion train to Buenos Aires, the vehicle being completely destroyed, and the driver and the five passengers killed. An investigation showed the accident to have been due to the recklessness of the driver of the bus, who was an old offender in this respect. As is usual in country districts where there is little road traffic, there were no barriers at the crossing.

Strengthening of Bridges by Welding

On October 17, Mr. H. A. McGillicuddy, A.M.Inst.C.E. (Chief Engineer, Cordoba Central Railway) inaugurated a discussion before the Buenos Aires Association of the Institution of Civil engineers on "Arc welding as applied to repairing and reinforcement of bridges." The Chairman of the Association, Mr. L. A. Woodbridge, M.Inst.C.E. (Chief Engineer, Central Argentine Railway) presided. Mr. McGillicuddy said that as compared with the cost of replacing weak girders, strengthening by this system cost only from 20 to 30 per cent. The Cordoba Central Railway had saved during the past two years over £80,000 by arc welding, as compared with complete renewals. Diagrams of important bridges on the Cordoba Central Railway were exhibited—including the Valderrama bridge, 400 m. (1,312 ft.) long—the reconstruction of which by arc-welding methods had been very satisfactory.

The Use of Long Rails

On October 24, at a meeting of the Association of British Engineers, presided over by Capt. G. W. Stevenson, Mr. J. H. Taylor, M.Inst.C.E. (Assistant Engineer (Indoor) Central Argentine Railway) read a paper on "Modern tendencies in permanent way practice," with special reference to the advantages of long rails. After referring to the efforts of chemists, metallurgists and engineers to produce a rail steel combining durability and strength, the lecturer remarked on the obvious advantages of long rails in reducing the number of rail joints. In Germany 30-m. (98½-ft.) rails had for some time been the standard on the State Railway, while quite recently 36-m. rails had been successfully transported to Egypt for experimental use on the State Railways there. The United States railroads, which had lagged considerably behind those of Europe in the matter of rail length, were now taking advantage of longer rails; though as yet little beyond 39 ft. had been rolled by American mills.

Rail Joints and Welding

On the subject of rail joints, the lecturer considered that the most scientifically designed fishplate in use today was the *Chevron*, for which M. Couillié, Chief Engineer of the French Midi Railway was responsible.

The lecturer went on to say that between long rails and long-welded lengths there was a wide gulf. Modern rolling mills were now able to manufacture rails up to 30 m. in length, but thanks to the enormous advance which had been made in the technique of welding, much greater lengths than this had been attained. On the Melbourne electrified lines of the Victorian Government Railways, rails were welded to lengths of 225 ft. On the German State Railway lengths up to 1,000 m. had been welded experimentally on stone-ballasted track. On the Delaware & Hudson Railroad a continuous rail-length of over 2,700 ft. had already been laid. All these rails were in the open, and so were subject to a wide range of temperature. Super rail lengths such as these required an exceedingly well-laid and equally well-maintained track. The lecturer then briefly described the different methods of welding used in the production of ultra-long rails—electric arc, Thermit, and resistance or flash-butt—with a few observations in regard to the relative merits of each method, and concluded with some remarks on fly packing.

The Transandine Railway

Señor Pinedo, Argentine Director-General of Customs, Chairman of the special committee appointed to inquire into the situation of the Transandine Railway, in a report recently presented to the Minister of Foreign Affairs stated that the railway had presented no plans for the reconstruction of that part of the line washed away by the Rio Plomo avalanche, and that the management had been requested to do so by the National Railway Board. How this work will be financed is not recorded, but the report states that a sufficient volume of passenger and goods traffic must be ensured, in order to justify a resumption and maintenance of the services, for which purpose it is probable that the commercial treaty between Argentina and Chile would be revised. In regard to the reconstruction, a technical sub-committee had made a careful study of this aspect of the problem, and it is stated that once the work of the Argentine committee has been completed, a joint Argentine and Chilean committee will be formed, so as to draw up a complete scheme.

NEW ZEALAND

Track Improvement Programme

The Government Railways Board in conjunction with an inter-departmental committee on public works has planned extensive railway grade and curve improvement works to be carried out as the board's contribution to the programme for the relief of unemployment. The most important of these, the easing of a steep grade on the Marton-New Plymouth main line, is estimated to cost £365,000. A grade on the North Island main trunk line between Greatford and Kakariki, will also be eased at a cost of approximately £26,000. Many minor grades on lines in both islands will be improved. The programme will absorb a large number of unemployed for a considerable period, and these improvements to the railway service will constitute a work of national importance. The grade easement on the New Plymouth line will reduce considerably the costs of haulage and maintenance, and will also make possible better and smoother running.

£37,000 Locomotive Shed Contract

The tender of the Fletcher Construction Company has been accepted by the Railways Board for the erection of the new locomotive and rolling stock running and repair sheds at the northern end of the new railway yards, Wellington. The sheds will measure 227 ft. × 239 ft. and so cover over an acre of ground. The contract price does not include the steel fabrication, which is being done at the Hutt railway workshops, or the driving of the 800 piles on which the building will stand. There will be five sections: for steam locomotives, electric locomotives, a central repair shop, a machine shop, and a car and wagon shop.

Special Design of Engine Pits

As the site is on recently reclaimed ground everything is carried on railway-grown timber piles, driven to solid and cut off below permanent water level, so that the concrete work will have to be taken to some depth below the ground surface. The solidity of the soil varies a good deal, but a few feet down it is wet generally, necessitating a special design in pits, which will run the lengths of the locomotive and car sheds. For the pit floors will be below the wet level and, as the ground has not fully consolidated, this rules out normal foundations. The pit sides will be long reinforced concrete beams, similar to bridge girders, supported at twelve-foot intervals on piles. To allow of gradual sinking as the ground consolidates an asphalt flooring

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is being laid, but later a permanent surface, in concrete, or whatever may be decided upon, will replace it.

SWEDEN

General Railway Policy

Commenting upon the recommended abolition of the Construction Department under the Railway Board, an article in *Svenska Dagbladet* emphasises the fact that this line of policy indicates the termination of the epoch of railway construction in Sweden. Both the State and private railways are too busy defending themselves against road competition to consider further extensions to their systems.

The only new construction at present in hand is on the line from Joenkoeping to Ulricehamn, a work that has been kept going since 1917, mainly with the idea of providing work for the unemployed. This line, which is known as the Inland Railway, has already cost nearly Kr. 61,000,000, Kr. 4,000,000 having been allocated annually for the work, and now only 17 km. remain to be constructed between Muoskosen and Jokkmokk. When the line is completed by the end of 1937 it will provide a third main route parallel to the existing main trunk line and the shorter coast line, and will give direct communication from Kristinenham, on Lake Vaener, to Gaellivare, in the far north.

GERMANY

Fare Concessions in connection with the Olympic Games &c.

Considerable fare concessions are being granted by the German State Railway to those participating in or visiting the forthcoming Olympic winter sports at Garmisch-Partenkirchen (February 6 to 16); the Olympic games at Berlin (August 1 to 16); and the yacht races at Kiel (August 4 to 15). Participants as well as club lenders, trainers, helpers, committee members, official press representatives, also relatives of those persons, will be allowed a 50 per cent. fare reduction in all classes, and an equal reduction on all supplements, with free conveyance of luggage and sports equipment up to 75 kg. weight (165 lb.) from home or frontier station to Garmisch, Berlin or Kiel and back. For the Garmisch sports the period covered will be from December 1 last to February 29, 1936, and for Berlin and Kiel from June 1 to September 30, 1936. One break of journey each way will be permitted but neither the outward nor the return journey must occupy more than four days.

Foreign participants or those living abroad who make use of these concessions instead of the usual 60 per cent. visitors' reduction, must pay in foreign currency, but if they use the latter rate they can claim the above luggage facilities. Such persons can also obtain a one-third reduction on express fares for journeys made from Berlin, Kiel or Garmisch, for all routes for which Mitropa tickets can be obtained. On the Berlin City, Ring, and local lines participants will be carried free from June 1 to September 30, 1936.

Visitors will be granted a one-third return fare reduction, equivalent to the Sunday concession, from any point on the State Railway to Garmisch, Berlin or Kiel, the period of availability being February 1 to 18, for Garmisch, and July 30 to August 18 for Berlin or Kiel. Return half tickets must bear a stamp showing that the holder really visited those places. Special period short journey season tickets will also be issued from places, such as Munich and Augsburg, in the neighbourhood of Garmisch to enable those persons who cannot find accommodation at Garmisch to travel to and fro as often as desired.

FRANCE

Nord Extends Automatic Signalling

The Lartigue electro-semaphore block, in use for nearly 60 years, is to be replaced on the principal main line sections of the Nord by automatic colour-light signalling. The section from Creil to Longueau has already been equipped, and the work is in hand between Longueau and Arras, Creil, Tergnier, and the Belgian frontier, as well as on the Paris suburban lines. The block sections are from 1,700 to 1,800 m. (1,860 to 1,970 yd.) in length, with three-aspect signals, the lights of which conform at present to the old code, but will be changed next year to agree with the new. On double line sections primary batteries with approach lighting are being used, but permanent lighting from mains is being installed where there are more than two tracks, to avoid confusing the drivers, as well as in the larger stations. The crocodile cab signalling apparatus has been retained with some slight modifications introduced by the Assistant Engineer, M. Ledard. The length of the sections will enable trains running at 150 km.p.h. (93¼ m.p.h.) to observe the "caution" indication satisfactorily with the existing brake equipment, and the abolition of so many intermediate block posts will effect considerable savings and promote greater safety.

SPAIN

Level Crossings

The official *Madrid Gazette* of November 21 published a decree signed by the Minister of Public Works, ordering the appointment of a permanent commission to consider the possibility of eliminating level crossings. The commission will be formed by selection from the existing personnel of the Railway Construction Division of the Ministry, and attention will be directed in the first place to the possibility of abolishing level crossings in the main roads radiating from Madrid, and especially those where traffic, by road or rail, or both, is heaviest. Each of the principal railway companies will be represented on the commission by one of its engineers. It is probable that in many cases, where the location is suitable, roads may be diverted or straightened out to avoid crossing railways, with great advantage to both forms of transport.

Malaga Fuengirola Railway

This narrow gauge railway, which was built and worked by the Belgian company, Suburbanos de Malaga, as a part of the Malaga-Algeciras-Cádiz strategic system, was handed over to the State by the company last year, as the guarantee for the extension to Algeciras was not forthcoming. The line was worked by the State until October 26, 1935, when notice was given that the line would be closed. As a consequence, however, of protests and appeals from local interests, and pending the debate upon the new railway law now before the Cortes, a fresh order has been issued, and appears in the *Madrid Gazette* of November 23, providing provisionally for the continued working of the railway.

CHINA

Delivery of Locomotives at Wuhu

Four new locomotives ordered by the Kiangnan Railway from a Continental firm have now been delivered, and were recently unloaded from one of the Belships at Wuhu for use on the Nanking-Wuhu section, lately opened. This line is now being extended southwards from Wuhu. Work upon the terminal station of the Hwainan Railway at Yuchi on the bank of the Yangtze opposite Wuhu is now in hand.

New Constructions

Following the completion of the Yuanping-Fenglingtu (Puchow) section of the Tatung-Puchow Railway [anticipated in our issues of October 18 and November 1—ED. *R.G.*], the official inauguration of public traffic over this 370-mile section of line took place on October 5. Fenglingtu is on the north bank of the Yellow River opposite Tungkwan, a station on the Lung-Hai Railway. The new line is, as previously stated, a light railway, but it is of metre and not standard gauge.

Construction is said to be starting this month upon another light railway in Ningsia, in the far north-west, to connect Yenchih, Holan Shan, Ninghsia City and Hengcheng, on the Yellow River, a distance of about 100 miles. Traffic expected is salt from Yenchih and coal from Holan Shan: arrangements for the purchase of materials are already being made in Shanghai.

A branch of the Lung-Hai Railway from Kweiteh to Pochow, in northern Anhwei, has been sanctioned by the Ministry of Railways. It will be about 40 miles in length.

XUM

NEW BELGIAN ALL-STEEL ROLLING STOCK

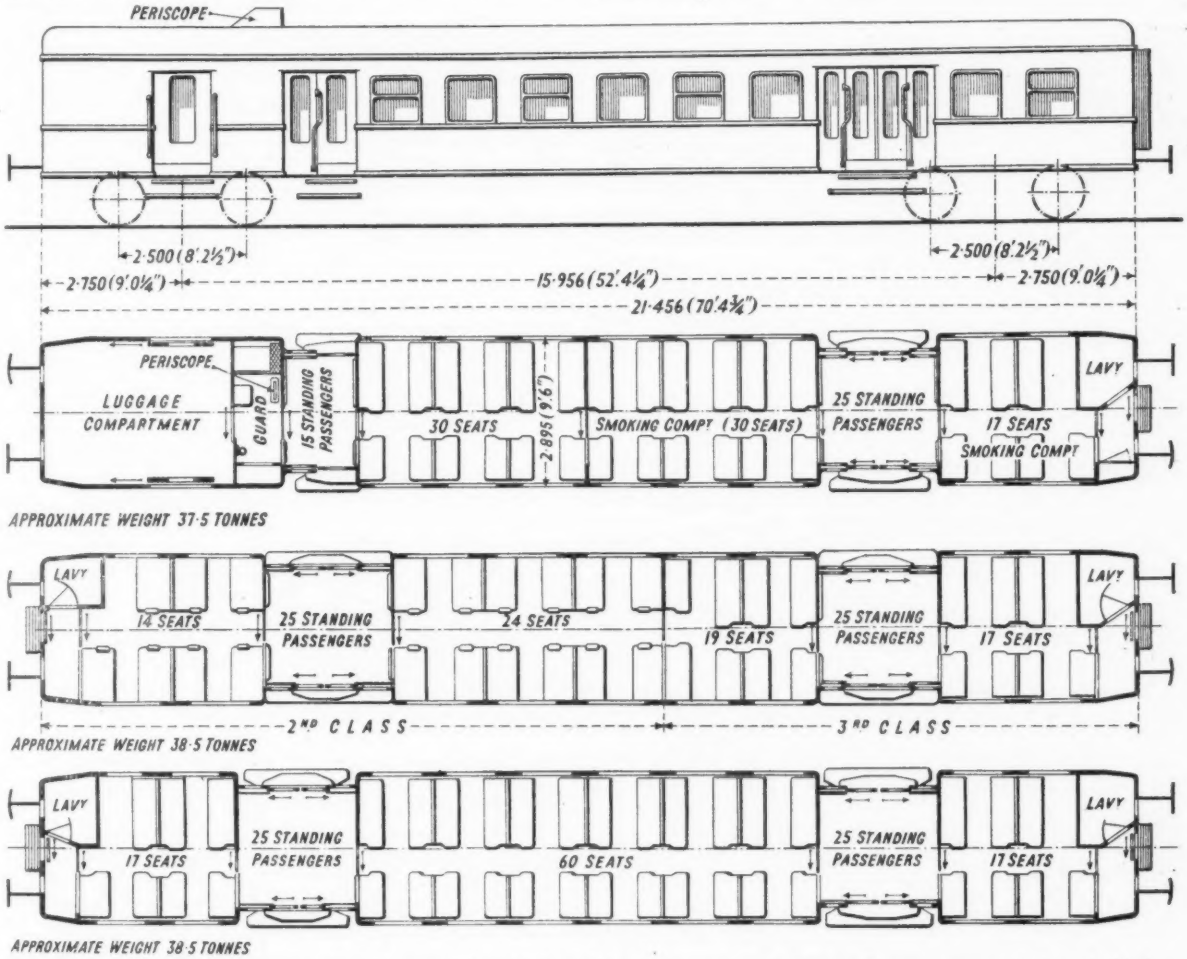
Orders for 500 all-steel carriages for suburban traffic have recently been placed by the Belgian National Railways Company

Following the construction of over 1,000 all-steel coaches for main line service in Belgium (described in THE RAILWAY GAZETTE of January 25, 1935, pages 136-144), the Belgian National Railways Company has recently placed orders for 500 all-steel coaches for suburban traffic. The orders comprise 250 third class, 125 second and third class composite, and 125 composite third class and luggage van coaches. The fifteen Belgian firms that have been entrusted with the building of these carriages are detailed in our Contracts and Tenders section on page 1034 of this issue.

As with the first 1,000 all-steel coaches, the Belgian National Railways Company itself will supply to each of the firms concerned a considerable quantity of materials and fittings. These include the bogies, seats, the metal fittings, roofs, floorings, forged and stamped pieces, heating and lighting apparatus, brakes, locks, headstocks, buffers and drawgear, and electro-pneumatically operated doors.

The object is to distribute as widely as possible the work required in connection with the order. The coaches will, as before, be built on the belt system and according to the size of the works concerned various builders will deliver one or two carriages a week each.

The accompanying elevation and plans show the general particulars of construction, together with weight and seating accommodation of each of the three types. In the body construction the same principles will be applied as those adopted for the earlier vehicles and described in the article already quoted, that is, body and underframe will be constructed as one unit having the ends specially reinforced with an anti-telescoping arrangement. The Pennsylvania type of bogie will be used.



Elevation and plan of new all-steel composite third and luggage van, and plans of composite second and third and of third class cars

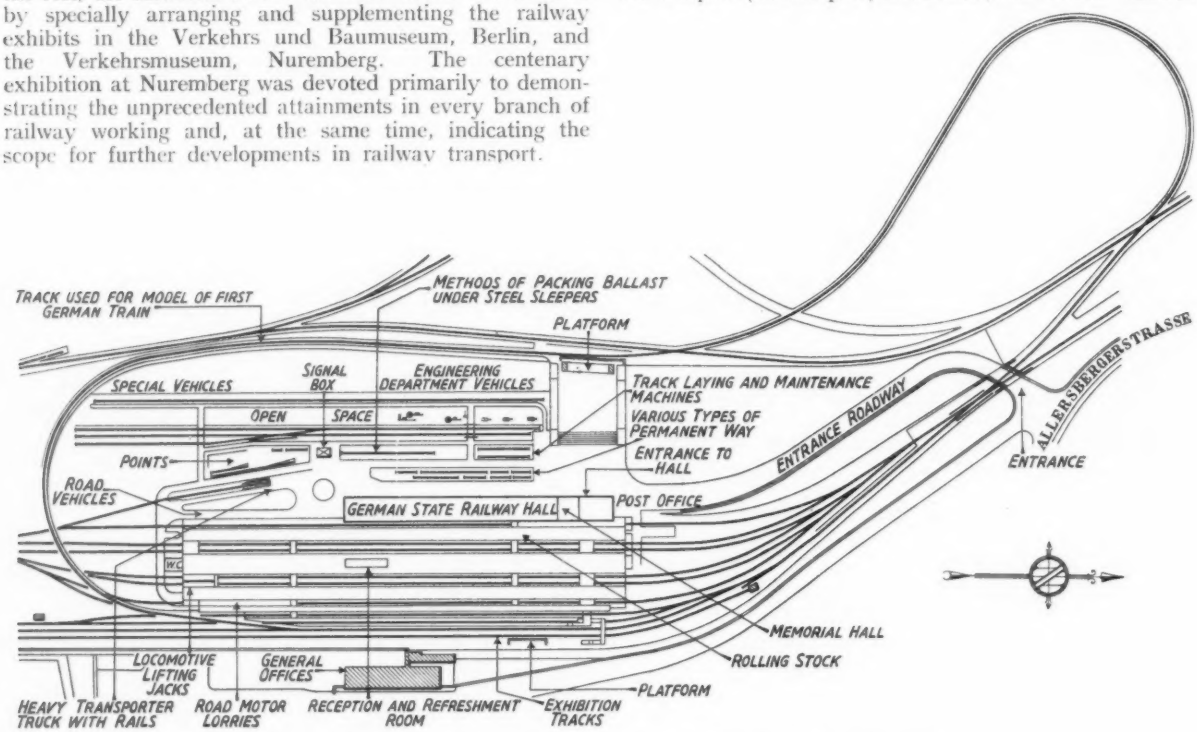
The walls will be lined internally with sheet iron, the roofs with plywood, in the third class carriages painted, and in the second class covered with painted fabric. The fittings will be of special light metal, and Securit safety glass will be used in the windows which will arranged alternately fixed and movable. The heating will be by steam, and the ventilation by air blowers and diffusers. Magnesian cement will be used for the flooring. The sliding doors will be opened by the passengers and pneumatically closed by the train staff.

XUM

"100 YEARS OF GERMAN RAILWAYS"

Exhibits at the Nuremberg centenary exhibition, July-October, 1935

THE completion of the first hundred years of railway development in Germany was celebrated by an exhibition, organised by the German State Railway Company at Nuremberg—the birthplace of German railways—and designed to provide a comprehensive survey of the present state of railway equipment and operation in Germany. The exhibition was closed on October 13, three months after its opening. The exhibits were all modern, with the exception of some pictorial records and a full-size model of the first German train and its locomotive *Der Adler* (*The Eagle*) built by Robert Stephenson & Company in 1835. This train ran on a loop track round the exhibition and was very popular with visitors. For the rest, the historical side of the celebrations was covered by specially arranging and supplementing the railway exhibits in the Verkehrs und Baumuseum, Berlin, and the Verkehrsmuseum, Nuremberg. The centenary exhibition at Nuremberg was devoted primarily to demonstrating the unprecedented attainments in every branch of railway working and, at the same time, indicating the scope for further developments in railway transport.



Site plan of the German railway centenary exhibition at Nuremberg

A large transhipping shed was erected last year at the Nuremberg marshalling yard to the south of the town, consisting of two 300 metre (984-ft.) halls of 60 metres (197 ft.) total width, with six tracks and platforms between. This building had not been put into service pending the completion of an annexe for dealing with road-borne traffic, and the whole was adapted to the needs of the exhibition at relatively small expense. The two outdoor tracks on the eastern side of the building were used for demonstrations of train control devices, by means of a railcar, an O1 series 4-6-2 express locomotive (visitors were allowed to ride on the footplate), and a permanent way measuring car. On the open ground to the west of the building there were shown specimens of permanent way construction, point and crossing work, a locking frame, and Culemeyer trucks for the road carriage of goods truck (THE RAILWAY GAZETTE, November 24, 1933); also, a portable siding for use in conjunction with Culemeyer trucks.

Reichsbahnrat Kaess was responsible for the business management of the exhibition; Reichsbahnoberrat Weiss and Reichsbahnrat Dr. Ing. Fackler for the architecture and decoration; and Professor Lechner was technical adviser.

Among items displayed in twelve rooms adjoining the entrance hall were operating exhibits showing the length, weight, speed and kinetic energy (32,200 metre-tonnes or about 104,000 ft. tons for an express train at 120 km.p.h. or 75 m.p.h.); gradients, up to 1 in 18 on the Höllentalbahn; acceleration, an a.c. railcar reaches 160 km.p.h. (99·4 m.p.h.) in 138 sec., and so on. Instructional coaches for personnel were shown on adjoining track. In the workshop room was a scale model of the new shops under construction at Nuremberg for the maintenance of railcars.

Ten steam locomotives were exhibited: (1) Two high-speed streamlined locomotives: viz. an 05 series 4-6-4 locomotive* and a series 61 4-6-4 tank engine,† both with coupled wheels of 2·3 m. (7 ft. 6½ in.) diameter and a boiler pressure of 20 at. (284 lb. per sq. in.). The former, a 3-cylinder simple, was designed to haul 250 metric tons at 175 km.p.h. (108·7 m.p.h.), and has hauled 200 metric tons at 191·7 km.p.h. (119·1 m.p.h.). The tank engine, a two-cylinder simple, is intended to haul a train of four streamlined coaches, weighing 124 metric

* See THE RAILWAY GAZETTE, June 21, 1935.
† See THE RAILWAY GAZETTE, March 1, 1935.

tons at 175 km.p.h. (108·7 m.p.h.). The streamline casing and the cab controls are arranged to suit either direction of running. A turbo-generator on the locomotive supplies lighting and other electrical requirements for the whole train, the locomotive and its coaches being always used as a unit.

(2) Three standard locomotives of types already in extensive use, with certain innovations: viz. on 01 series 4-6-2 express locomotive, 2-6-2 passenger tank locomotive of series 64, and 2-8-2 goods tank locomotive, series 86. A new feature in these locomotives is the provision of increased braking. All wheels are fitted with double brakes having divided brake shoes.

(3) The latest standard locomotives: viz. the 2-4-2 passenger tank locomotives, series 71, for secondary railways, and the light 0-6-0 shunting locomotive series 89. The former, intended for use on secondary lines at speeds up to 90-100 km.p.h. (56-62 m.p.h.), has a boiler pressure of 20 at. (284 lb. per sq. in.), welded copper firebox, and reinforced braking with a lever coupled to the reversing gear so as to alter the brake block pressure to suit the direction of running. The series 89 locomotive was superheated. Similar saturated steam locomotives are operated at 14 at. (199 lb. per sq. in.) because sufficient expansion could not be obtained with saturated steam at the higher pressure.

(4) Three medium-high pressure (25 at. or 355 lb. per sq. in.) locomotives, viz.: The 4-6-2 four-cylinder compound express locomotive, series 02 (originally designated 04); the 2-10-0 four-cylinder compound goods locomotive, series 44; and the two-cylinder compound locomotive 2-6-0, series 24. The fireboxes in these locomotives are of 10-11 mm. (0·393-0·433 in.) alloy steel, molybdenum or chromium-molybdenum steel of 52 kg. per sq. mm. (33 tons per sq. in.), with stays of 35-44 kg. (22·2-27·9 tons) steel. The series 02 Pacific has reinforced braking.

Diesel Exhibits.—Three examples of diesel tractors as used at intermediate stations were shown. One of these had gear drive; another the Voith hydraulic transmission, and the third a producer gas transmission. For train work on the line, was shown a 1,300 b.h.p. diesel locomotive with hydraulic transmission. The high-speed railcars shown were the original two-coach articulated *Flying Hamburger*, and the three-coach *Leipzig* type. The other diesel exhibits included double-bogie and four-wheeled cars, all of which were recorded in the *Diesel Railway Traction Supplement* for November 1.

Passenger Coaches.—The exhibits showed the special attention paid to the comfort of passengers. Wide windows, all of which open right down, permit unrestricted view. The seating arangements are specially comfortable, and heating is by the Pintsch circulating system (excepting in railcars) with automatic control and three stages of adjustment. The coaches are of all-metal construction, and extensive use is made of welding. Bogies are of the simple Görlitz type. All passenger coaches have lavatory accommodation.

The following vehicles were exhibited: Second and third class bogie corridor coach for P and E trains, seating 60, and weighing 34·5 metric tons; a first, second and third class bogie corridor vestibule coach for D trains, seating 56, and weighing 39 metric tons. Mitropa sleeping and restaurant cars; two mail and parcels vans; and a light trailer for railcars, with a new type of bogie, seating 90 and weighing only 13·4 metric tons.

The coaches of the high-speed steam train (160 km.p.h. or 99·4 m.p.h.) are internally similar to those of the D train coaches, but air resistance is reduced by close-coupling the coaches and fitting a full-profile bellows connection, by an undercarriage apron, and by keeping windows and doors flush with the sides. Scharfenberg couplings are used, with buffers on the underframe and above the end doors to prevent rolling. The floor of the coaches is 1·09 m. (3 ft. 7 in.) above rail level (compared with the usual 1·24 m. or 4 ft. $0\frac{13}{16}$ in.) to lower the centre of gravity. One of the steps is inside the door, the other folds and is operated by compressed air. The four coaches with 48 second-class and 144 third-class seats weigh about 125 metric tons. Electric lighting supply is from a generator on the locomotive, and the air is warmed by steam-heaters. All four coaches are mounted on Fischer roller bearings.

Electric Locomotives.—The electric locomotives exhibited were:—

(1) 1-Do-1 (Type E18) with four axles driven by individual motors, and welded plate frames. (*See Electric Railway Traction Supplement* for September 20).

(2) Lighter express locomotive, type 1-Co-1 (EO4), with outside frames of welded plate. Built for speeds up to 130 km.p.h. (81 m.p.h.).

(3) Type Bo-Bo, E44 goods and passenger locomotive; hauls 1,200 metric tons on the level and 700 metric tons in mountainous districts at 90 km.p.h. (56 m.p.h.).

A two-coach single-phase railcar was shown for speeds up to 160 km.p.h. (100 m.p.h.). The whole of the electrical equipment is below the coach body, including a 3-ton transformer. The end bogies are driven on each axle; total 1,200 h.p. Total weight 90 metric tons, including 77 second-class passengers. Acceleration 0·7 metre p.s.p.s. (2·3 ft. p.s.p.s.). A glass-topped observation motor coach was another exhibit; it was described in the *Electric Railway Traction Supplement* for October 17. Electrical track equipment, with various arrangements of overhead lines for high-speed working, was exhibited.

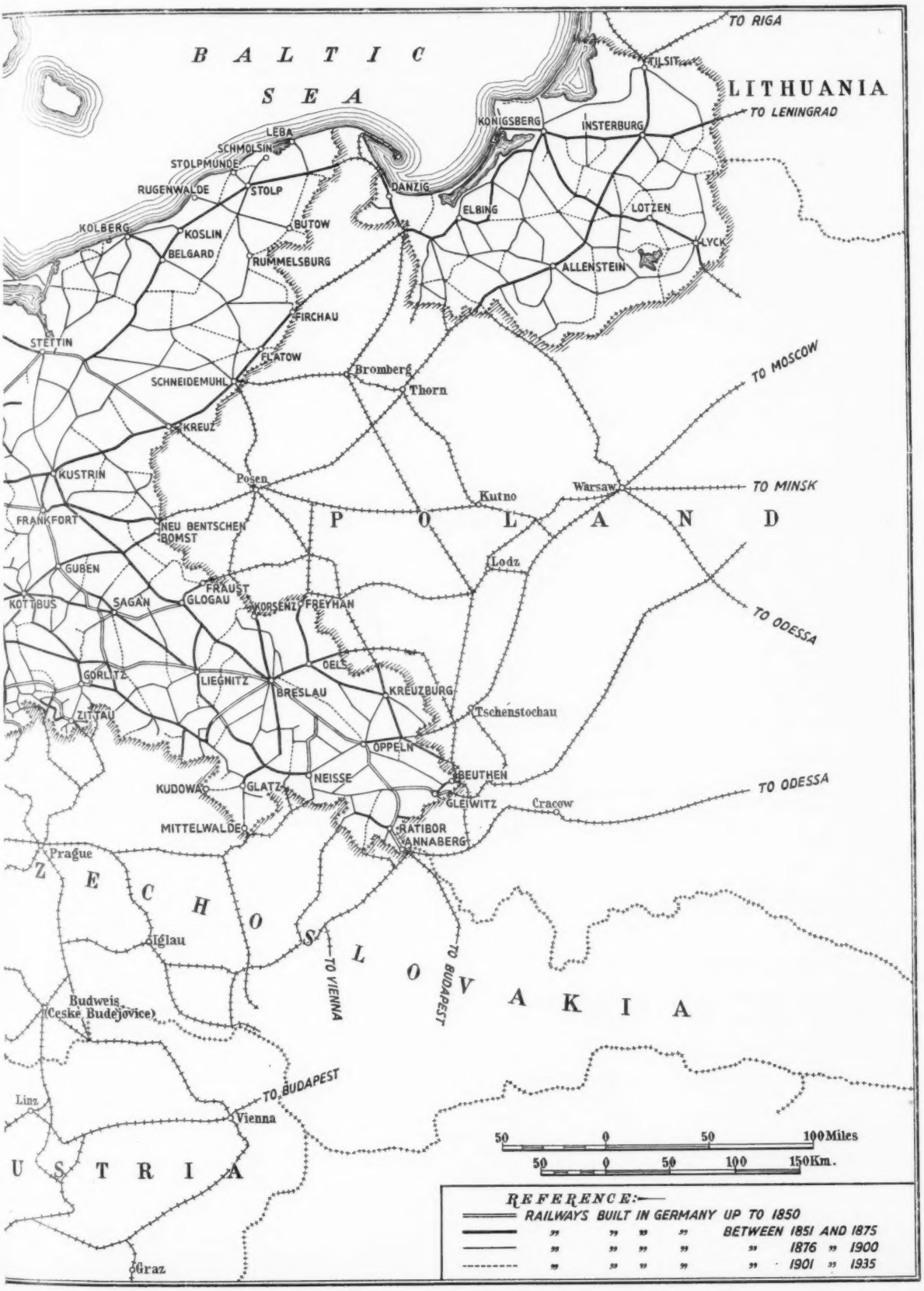
Goods Wagons.—As representative of wagons for high speeds, an eight-wheeled covered goods wagon type GGhs was shown, with Görlitz bogies. Also, a four-wheeled covered wagon with a wheelbase of 7 m. (22 feet $11\frac{9}{16}$ in.) and both wheel sets arranged as bissels. The loading lengths of the two wagons are 15 and 9 m. ($49\frac{1}{4}$ ft. and $29\frac{1}{2}$ ft.), and the tares 22·7 and 12·7 metric tons respectively, for 15 metric tons carrying capacity in each case. The high-arched roof is now standard for all covered wagons. Both the wagons exhibited had passenger-train brakes with change-over arrangements, and ring-spring buffers (32 metric tons final compression). Developments in light construction were represented by a four-wheeled open wagon, type Om, of 20 metric tons capacity and tare 8·9 metric tons. This wagon has bissels on a 4·5 m. (14 ft. $9\frac{3}{16}$ in.) wheelbase, and sleeve buffers for 16 metric tons final compression. An insulated van for the English ferry service was shown with two ice boxes, and an air-circulating plant.

An eight-wheel self-discharging coal wagon exhibited had a saddle-bottom body with side discharge; capacity 75 cu. m. (2,648 cu. ft.); light Uerdingen wheel sets for axle loads of 20 metric tons. The hopper wagon for coal or coke had three 12 cu. m. (424 cu. ft.) hoppers, giving a total capacity of 27 metric tons of coal with a tare of 12·8 metric tons. Other exhibits were: (1) The 140 metric tons dropped frame wagon, the largest belonging to the Reichsbahn, with two ten-wheeled bogies; welded construction, tare 55 metric tons, with buffers of 45 metric tons full compression. (2) A breakdown crane capable of lifting 75 metric tons at 9·5 m. (31 ft. 2 in.), and 20 metric tons at 19 m. (62 ft. 4 in.).

Brakes.—The developments exhibited were the increased brake pressure made possible by double brake shoes (divided shoes with subdivided soles), as used in all new locomotives and vehicles for fast trains; and a centrifugal regulator for varying the brake block pressure to

XUM

NORTH SEA
SWEDEN
DENMARK
Esbjerg
Fredericia
Odense
Nyborg
Korsor
Faaborg
Copenhagen
Malmo
FLENSBURG
Gjedser
PREROW
SASSNITZ
STRALSUND
KIEL
RUSUM
WARNEMUNDE
ROSTOCK
CUXHAVEN
WISMAR
LUBECK
NORDDEICH
HERLE
WILHELMSHAVEN
WESERMUNDE
STADE
HAMBURG
SCHWERIN
WAREN
EMDEN
LEER
LUNEBURG
BUNDE
OLDENBURG
BREMEN
WITTENBERGE
NEUSTADT
MEPPEN
QUAKENBRUCK
CELLE
BERLIN
Amsterdam
SALZBERGEN
HANOVER
Utrecht
OSNABRUCK
BRUNSWICK
GRONAU
HOLLAND
MAGDEBURG
MUNSTER
CLEVE
WESEL
DESSAU
TO FLUSHING
HAMM
DORTMUND
HALLE
TO ANTWERP
KASSEL
LEIPZIG
MUHLHAUSEN
RHEYDT
COLOGNE
TO BRUSSELS
ERFURT
SIEGEN
BEBRA
DRESDEN
AACHEN
JENA
Liege
BONN
MARBURG
CHEMNITZ
BELGIUM
GREIZ
FULDA
PLAUEN
ANNABERG
GEROLSTEIN
COBLENZ
COBURG
TO BRUSSELS
FRANKFORT
MAINZ
BAMBERG
C
TRIER
WURZBURG
Luxemburg
WEIDEN
Pilsen
KUSEL
MERZIG
MANNHEIM
AMBERG
WALDMUNCHEN
NUREMBERG
SAARBRUCKEN
ANSBACH
FURTH IM
PIRMASENS
HEILBRONN
TO PARIS
REGENSBURG
KARLSRUHE
GRAFENAU
Nancy
INGOLSTADT
Strasbourg
STUTTGART
LANDSHUT
FRANCE
PASSAU
ULM
AUGSBURG
Epinal
MUHLDORF
MUNICH
FREIBURG
BIBERACH
A
Belfort
Basle
CONSTANCE
KONIGSSEE
Zurich
TO LYONS
SWITZERLAND
OBERSTDORF
MITTENWALD
TO VENICE, FLORENCE & ROME
TO TRIESTE
TO GENEVA
TO GENOA
Innsbruck


BALTIC SEA
TO RIGA
TILSIT
LITHUANIA
TO LENINGRAD
KONIGSBERG
INSTERBURG
LEBA
SCHMOLSIN
STOLPMUNDE
RUGENWALDE
STOLP
DANZIG
ELBING
LOTZEN
KOLBERG
KOSLIN
BUTOW
BELGARD
RUMMELSBURG
LYCK
ALLENSTEIN
FIRCHAU
STETTIN
FLATOW
Bromberg
TO MOSCOW
SCHNEIDEMUHL
Thorn
KREUZ
KUSTRIN
Posen
Kutno
Warsaw
TO MINSK
FRANKFORT
NEU BENTSCHEN
BOMST
POLAND
Lodz
GUBEN
FRAUST
GLOGAU
KOTTBUS
SAGAN
KORSENZ
FREYHAN
TO ODESSA
GORLITZ
LIEGNITZ
OELS
BRESLAU
KREUZBURG
ZITTAU
Tschenstochau
OPPELN
BEUTHEN
KUDOWA
GLATZ
NEISSE
GLEIWITZ
Cracow
TO ODESSA
MITTELWALDE
RATIBOR
ANNABERG
Prague
CZECHOSLOVAKIA
Iglau
TO VIENNA
TO BUDAPEST
Budweis
(Ceske Budejovice)
Linz
TO BUDAPEST
Vienna
AUSTRIA
Graz
50 0 50 100 Miles
50 0 50 100 150 Km.
REFERENCE:
RAILWAYS BUILT IN GERMANY UP TO 1850
" " " " BETWEEN 1851 AND 1875
" " " " " 1876 " 1900
" " " " " 1901 " 1935

compensate for the change in coefficient of friction with speed (this new device was shown on the steam locomotives, series 05 and 61, the electric locomotive E18, and the Stadtbahn train). The rapid release of pressure in the brake line, essential at high speeds, is secured by accelerator release valves at both ends of coaches (as shown in the D train coaches exhibited), or by electrically operated valves (in the Stadtbahn train). The diesel and electric railcars and the coaches of the streamlined train showed the use of special brake drums and discs with friction linings (coefficient of friction 0·35).

Road Vehicles.—Representing the new activities of the German State Railway in road transport service, there were three 5-ton lorries, with suction gas plant, steam, and diesel drive respectively. The diesel vehicle was equipped to haul a large mobile container from the ground on to its platform. Equipment shown for hauling loaded goods wagons through the streets included, besides the truck hauled by a tractor, a 12-wheeled self-propelling truck. The advantage of the self-contained construction is that the carried weight is available for adhesion. The vehicle weighs 11 metric tons and can carry goods wagons weighing up to 32 metric tons up a 1 in 20 gradient. A heavy-load road vehicle shown for the transport of objects exceeding the railway loading gauge is mounted on 24 wheels and carries 80 metric tons on a tare weight of 12 metric tons.

Permanent Way, Safety and Communications.—Numerous outdoor and indoor exhibits showed the main features of modern German permanent way practice. The K49 construction consists of rails weighing 48·9 kg. per m. (98·6 lb. per yd.), in 30 m. (98 ft. 5⅛ in.) lengths, hook-bolted to ribbed sole plates with slips of poplar between rail and sole plate for smooth, silent running and firm grip, the sole plate being coach-screwed to wooden, or welded to steel sleepers. This rigid construction prevents creeping and changes in length due to temperature variations, and permits the use of smaller gaps between rails.

Other types shown included the B permanent way with hook bolts holding rails directly to perforated steel sleepers; tunnel permanent way T 49 with wooden sleepers and cast iron chairs holding the flat-bottom rails by means of large double wedge keys.

Rail joints in the standard K 49 construction are carried by double sleepers and a long sole plate; about 6 in. under the rail ends is left hollow to permit of deflection. Experimental exhibits were the Melaun joint with a rail-flange clamp, and the Rüping and Vogel joint bridge. The latest flat turnouts 49-1200-1 : 18.5 of the German State Railway have a total length 64·818 metres (212 ft. 8 in.), a radius of 1,200 m. (3,937 ft.), and can be traversed at 100 km. (62·1 miles) an hour. The tongue is 15 m. (49 ft. 2⅝ in.) in length and has two locking clamps.

Track laying methods were demonstrated, including a relaying machine. Ballast is compressed with a 6-ton roller, and ribs of ballast are formed with moulds before laying the steel sleepers. Rail-welding exhibits included Thermit demonstrations and the electric resistance welding of joints.

Signalling and Train Control.—The exhibits drew special attention to improvements in visibility and reliability of light signals; long-burning lamps (14 days) with propane gas; and the use of an additional arm on distant signals to show when the home signal orders a speed reduction (see THE RAILWAY GAZETTE, November 17, 1933). The signalling exhibits were shown in operation from a box containing a four-row electric locking frame, demonstrating the compactness of the apparatus and the clear view obtainable by the operator. Automatic signalling equipment was shown in use; also inductive and optical train-control apparatus. Train dispatching was demonstrated, the central control equipment including telephone connections with stations, a loud speaker and long-range microphones for receiving and acknowledging reports of train movements, a self-correcting clock operated by time signal, and an electric subsidiary clock. Wireless equipment, for communication between control box and shunting locomotive, was shown in action (01 locomotive).

A Brief Chronology of German Railway Development

July 10, 1833.—Bavarian Government decides to buy two shares in the proposed Nuremberg-Fürth Railway!

July 18, 1833.—Baden appoints a commission to investigate railway construction.

February 19, 1834.—Ludwig I, King of Bavaria, gives his Royal Assent to the construction of the railway from Nuremberg to Fürth.

July 25, 1835.—Rhenish Railway Company established.

August 27, 1835.—Stephenson despatches *Der Adler*; it arrived, Nuremberg, October 26.

First Railway opened

December 7, 1835.—First German railway (the Ludwigsbahn) opened between Nuremberg and Fürth.

February 11, 1836.—Committee formed to extend the Ludwigsbahn to Bamberg and Hof; principal promoter, Johannes Scharrer, Mayor of Nuremberg. (This was abortive so far as the Ludwigsbahn was concerned.)

August 2, 1836.—All platelayers of the Ludwigsbahn provided with flags.

September 28, 1836.—Bavarian Railways Act passed; Bavaria decides that all lines in that State shall be to Stephenson's (standard) gauge.

April 24, 1837.—First Saxon railway opened, between Leipzig and Alten.

August 21, 1837.—Cologne-Aachen line authorised.

February 10, 1838.—Agreement made between Baden, Hessen,* Nassau, and the Free City of Frankfort-on-Main for the construction of the Main-Neckarbahn from Frankfort to Heidelberg via Darmstadt.

February 10, 1838.—First Parliamentary Order made in Baden concerning a proposed Badish railway system.

March 29, 1838.—Decision of the Baden Parliament to build a railway from Mannheim to the Swiss frontier.

April 19, 1838.—Concession granted for the first railway in the Palatinate, from Rheinschanze to Bexbach.

July 19, 1838.—Dresden-Weintraube line opened.

September 3, 1838.—Augsburg to Lechbrücke line opened with horse transport.

September 16, 1838.—Weintraube-Oberau section of Dresden-Leipzig line opened.

September 20, 1838.—Düsseldorf-Erkrath line opened.

September 22, 1838.—First Prussian railway opened, between Berlin and Zehlendorf.

October 29, 1838.—Berlin-Potsdam line completed and opened throughout.

First State Railway

December 1, 1838.—First German State Railway opened, between Brunswick and Wolfenbüttel.

April 7, 1839.—First locomotive-operated railway in Saxony opened between Leipzig and Dresden, via Oschatz and Priestewitz; this included the first German tunnel, at Oberau, recently demolished (see *R.G.* June 7, 1935, p. 1105).

August 2, 1839.—First part of the Cologne-Aachen line opened, to Mungersdorf.

August 25, 1839.—Opening from Munich to Moisach of the Munich-Augsburg line.

April 13, 1840.—Frankfort (Main)-Kastel-Mainz-Wiesbaden line opened.

July 23, 1840.—Köthen-Halle line opened, completing through connection between Magdeburg and Halle.

August 3, 1840.—Construction of Berlin-Stettin line begun.

August 18, 1840.—Halle-Leipzig section opened, completing through connection Magdeburg-Dresden.

September 1, 1840.—Köthen-Dessau line opened.

Pioneer line in Baden

September 12, 1840.—First railway in Baden opened, from Mannheim to Heidelberg.

October 4, 1840.—Munich-Augsburg line opened throughout.

July 1, 1841.—Opening of Berlin-Jüterbog line.

August 2, 1841.—Concession granted to the Upper Silesian Railway Company for building the Breslau-Oppeln line.

September 3, 1841.—Vohwinkel-Elberfeld line finished. Through connection Düsseldorf-Elberfeld.

September 3, 1841.—Düsseldorf-Elberfeld line completed, via Erkrath and Thaan. (See September 20, 1838.)

September 10, 1841.—Berlin-Anhalt Railway opened from Berlin to Köthen.

September 10, 1841.—Jüterbog-Wittenberg line opened, completing through connection Berlin-Köthen-Halle-Leipzig-Dresden.

February 19, 1842.—Trial trip made from Hamburg to Bergedorf; line opened on May 16, 1842.

* "Hessen" or "Hesse-Darmstadt" is the Grand Duchy of Hesse. "Kurhessen" or "Hesse-Kassel" is the Electorate of Hesse.

May 22, 1842.—Opening of the Silesian line from Breslau to Ohlau.

July 16, 1842.—Law passed in Hessen authorising the establishment of State Railways.

July 30, 1842.—Berlin-Neustadt (Eberswalde) line opened.

October 22. 1842.—Frankfurt-on-Oder to Berlin line opened, via Furstenwalde.

April 10, 1843.—Heidelberg-Karlsruhe line opened.

April 18, 1843.—First Württemberg Railway Construction Act passed.

Fourth Class Introduced

May 1, 1843.—Introduction of the fourth class (with standing accommodation only) in Baden; abolished on May 1, 1853.

July 10, 1843.—Wolfenbüttel-Oschersleben line opened.

July 15, 1843.—Magdeburg-Oschersleben-Halberstadt line opened, completing through connection Berlin - Köthen - Magdeburg - Wolfenbüttel-Brunswick line; Wolfenbüttel (near Brunswick)-Oschersleben line opened. (See December 1, 1838.)

July 27, 1843.—Berlin-Hamburg Railway Company established.

August 15, 1843.—Completion of Berlin-Stettin line, between Angermünde and Stettin, and ceremonial opening.

Rail Connection with Belgium

October 21, 1843.—Cologne-Düren-Aachen-Herbesthal line (see August 2, 1839) opened (same day as Belgian line between Verviers and Herbesthal).

October 28, 1843.—Breslau-Schweidnitz-Freiburg line opened.

February 15, 1844.—Opening of Cologne-Bonn line.

June 1, 1844.—Oos-Offenburg and Appenweier-Kehl lines opened.

June 12, 1844.—Concession granted to the Bergisch-Märkisch Railway Company.

First Bavarian State Railway

August 25, 1844.—First State line in Bavaria opened, between Nuremberg and Bamberg.

September 18, 1844.—Altona-Kiel line opened.

February 6, 1845.—State Agreement concluded between Hessen, Kurhessen, and the Free City of Frankfort-on-Main for the construction of the Main-Weser Railway from Frankfort to Kassel via Giessen.

February 28, 1845.—Prussian concession granted for Berlin-Hamburg Railway; Lübeck concession April 16; Hamburg concession, April 21; Danish concession, April 25.

July 25, 1845.—Oos-Baden line opened.

July 31, 1845.—Offenburg-Freiburg line opened, completing through connection Mannheim-Karlsruhe-Freiburg.

A Line in Württemberg

October 22, 1845.—First Württemberg railway (a State line) between Cannstatt and Untertürkheim opened.

May 22, 1846.—Bavaria adopts the State railway principle.

May 28, 1846.—Breslau-Oppeln Railway opened. (See August 2, 1841, and May 22, 1842.)

August 1, 1846.—Dresden-Pirna line opened.

August 7 *to September* 15, 1846.—Potsdam-Magdeburg line opened, completing through connection Berlin-Magdeburg-Brunswick-Hanover.

September 1, 1846.—Frankfort (Oder) to Bunzlau line, completing through connection Berlin to Breslau.

November 10, 1846.—Prussian Railway Association formed. Now the Central European Railway Association.

May 15, 1847.—Ruhr line (Duisburg-Dortmund-Hamm) of the Cologne-Minden Railway opened.

June 24, 1847.—Opening of last section (Gotha-Eisenach) of through line from Halle via Erfurt and Weimar.

October 15, 1847.—Hanover-Wunstorf-Minden line opened.

July 1, 1848.—Jüterbog-Herzberg line opened.

July 25, 1848.—Bietigheim-Heilbronn line opened.

September 10, 1848.—Franfort-Hanau line opened.

October 1, 1848.—Direct connection Berlin-Dresden completed via Herzberg and Röderau.

February 10, 1849.—Concession granted to Lübeck-Büchen Railway Company.

March 6, 1849.—Haueda-Hümme line opened.

March 9, 1849.—Düsseldorf-Elberfeld-Hagen; Hagen-Vorhalle-Witten; and Witten-Dortmunderfeld lines opened.

July 1, 1849.—Magdeburg-Stendal-Wittenberge line opened.

September 25, 1849.—Belira-Gerstungen-Eisenach line opened.

September 30, 1849.—Through connection between Nuremberg and Munich completed via Pleinfeld and Schwabach.

June 29, 1850.—Opening of Geislingen-Ulm section, completing through line from Cannstatt.

September 15, 1850.—First Prussian State Railway line opened, from Wellesweiler to Neunkirchen.

January 22, 1851.—Final section of the Mannheim-Basle line opened, between Efringen and Haltingen.

October 15, 1851.—Lübeck-Büchen Railway opened.

May 15, 1852.—Opening of final section (Giessen-Lang Göns) of Frankfort-Marburg-Kassel railway.

Air Brakes

March 10, 1853.—First Prussian patent for compressed air brakes.

August 1, 1853.—Königsberg-Marienburg line opened.

April 15, 1854.—Completion of conversion of Baden 5 ft. 3 in. gauge lines to standard gauge.

May 1, 1854.—Opening of Augsburg-Ulm line.

February 15, 1856.—Emmerich-Dutch frontier (Zevenaar) line opened.

April 12, 1856.—Concession granted to the Bavarian Eastern Railway Company for lines: Nuremburg - Regensburg - Passau; Munich - Landshut-Dorau; and Schwandorf-Fürth.

December 19, 1856.—First Thuringian railway opened, from Weimar to Weissenfels.

June 1, 1857.—Introduction of through Frankfort-Basle carriages.

December 16, 1858.—Train service opened on the first section of the Saarbrücken-Trier line.

May 26, 1860.—Opening of final section (Merzig-Trier) of Trier-Saarbrücken line.

June 15, 1863.—Completion of last section (Waldshut-Constance) of Basle-Constance line.

April 4, 1864.—Introduction of the fourth class, at first on the Dresden-Tharandt section.

Rhine Pontoon Bridge

May 8, 1865.—First railway pontoon bridge in the world (across the Rhine to Maximiliansau) opened.

February 25, 1867.—Girder bridge opened across the Rhine between Mannheim and Ludwigshafen.

January 18, 1870.—Trier-Cologne line opened.

April 11, 1870.—Gotha-Mülhausen line of Thuringian Railway Company opened.

March 31, 1873.—Blankenburg-Halberstadt line opened.

July 1, 1873.—Completion of through line between Regensburg and Nuremberg.

November 10, 1873.—Black Forest line completed.

August 15, 1874.—Ingolstadt-Donauwörth line completed.

September 15, 1874.—Opening of Central Goods station at Mannheim.

January 4, 1875.—Uniform signalling regulations introduced.

April 15, 1875.—Bavarian State acquires Eastern Railway Company.

June 17, 1875.—Berlin-Zossen-Elsterwerda-Dresden, and Dresden-Chemnitz lines opened.

July 10, 1877.—Berlin-Neubrandenburg line opened.

July 15, 1877.—Nuremberg-Schnabelwaid-Bayreuth lines opened.

February 8, 1878.—Permanent Commission on Rates and Fares appointed.

Uniform Construction Standards

June 12, 1878.—Uniform standards adopted for construction and equipment of main line railways.

August 7, 1878.—Prussian Ministry of Public Works established; von Maybach appointed first Minister.

March 1, 1879.—Zweibrücken-Saargemünd line opened.

March 15, 1879.—Mosel Railway from Güls to Ehrang opened; this included the Cochem tunnel, 4,203 metres, the second longest in Germany.

May 22, 1879.—Oldenburg Hauptbahnhof opened (demolished, 1912).

September 15, 1879.—Düsseldorf-Gerresheim-Varresbeck-Haspe-Hagen line opened.

September 22, 1879.—An electric light installation opened at Munich Central station.

February 14, 1880.—Prussian State takes over the Berlin-Potsdam-Magdeburg and the Rhenish Railways.

October 17, 1881.—First narrow gauge (0·75 m.) line in Saxony (Willkau-Kirchberg) opened.

February 6, 1882.—Friedrichsstrasse station, Berlin, opened.

February 7, 1882.—Opening of the Berlin City Railway (Stadtbahn) between Charlottenburg and the Silesian terminus.

Prussian Nationalisation Law

March 28, 1882.—Prussian law passed regulating the acquisition of private lines by the State.

May 13, 1882.—Berlin-Anhalt Railway acquired by the State.

August 1, 1882.—Lübeck-Travemunde line opened.

January 24, 1884.—Altona Divisional Administration of the Prussian State Railway founded. Altona-Kiel Railway taken over by the Prussian State.

March 1, 1884.—Kreuzthal-Hilchenbach line opened.

March 24, 1884.—Prussia concluded agreement to acquire Berlin-Hamburg Railway Company.

April 21, 1884.—Bavarian Local Railways Act passed.

August 1, 1884.—Plaue-Suhl line and Brandleite tunnel opened.

A Rack Railway

August 23, 1884.—Rack railway from Stuttgart to Degerloch opened.

October 1, 1884.—Opening of Mainz Central station and tunnel. (Since opened out.)

January 20, 1885.—Parchin-Karow-Neubrandenburg line opened.

February 23, 1885.—Prussian State took over certain lines of the Brunswick Railway Company.

March 1, 1885.—Schleswig Railway taken over by the Prussian State.

October 1, 1885.—Eichicht-Probstzella line opened.

May 23, 1887.—Freiburg-Neustadt section of Höllentalbahn opened.

April 1, 1888.—Saxony acquires the Dresden-Elsterwerda section of the main line to Berlin.

August 18, 1888.—Frankfort-on-Main Central station opened.

March 1, 1890.—Formation of Archducal Administration of the Mecklemburgisch-Friedrich Franz Railway in Schwerin.

Corridor Trains Introduced

May 1, 1892.—Corridor (D or durchgehende) trains introduced.

July 5, 1892.—New operating regulations for principal German railways substituted for the Railway Police Regulations of 1871. Similar regulations introduced for light railways.

November 15, 1892.—Uniform Traffic Regulations introduced for all German railways.

Central European Time

April 1, 1893.—Central European Time (M.E.Z.) introduced.

April 1, 1895.—Reorganisation of the Prussian State Railways.

June 21, 1896.—Hessian Ludwigsbahn purchased by Prussia and Hesse.

June 23, 1896.—Prussia and Hesse conclude agreement for the common administration of their railways.

July 20, 1897.—Highest situated station in Saxony opened; Oberwiesenthal (892 m.).

December 20, 1897.—Magdeburg-Halberstadt Railway Company taken over by Prussia.

January 18, 1899.—Military transport regulations introduced.

February 25, 1899.—State agreement concluded between Hamburg and Prussia whereby Hamburg abandoned the right to repurchase the Cologne-Minden Railway and Prussia took over in perpetuity the working of the Hamburg Junction Railway.

March 1, 1899.—Landsberg-Bruckenvorstadt-Landsberg-Warthe line opened.

August 21, 1899.—Saxon State establishes street tramway lines.

October 1, 1899.—Lindau-Friedrichshafen line opened.

March 1, 1900.—Biberach-Warthausen line opened.

XUM

March 1, 1901.—Möhrlenbach-Wahlen line opened.

October 1, 1901.—Ueberlingen-Friedrichshafen line opened.

February 14-17, 1903.—Agreement concluded for nationalising Eckenförde-Flensburg Railway.

March 1, 1903.—Grünstadt Altleimingen line opened.

Suburban Electrification

June 15, 1903.—Electric traction introduced on the suburban line between Berlin and Lichterfelde-East.

July 15, 1903.—Southern Railway of East Prussia taken over by the State.

October 1, 1903.—Train ferry between Warnemünde and Gjedser (Denmark) opened.

May 2, 1904.—Mainz-Wiesbaden-Biebrich line opened.

November 4, 1904.—Repeal of the Railway Construction and Operation Act, to have effect as from May 1, 1905.

February 14, 1906.—Berlin Transport and Civil Engineering Museum opened.

October 1, 1906.—Donauwörth-Treuchlingen line opened.

December 5, 1906.—Hamburg Central station opened.

April 1, 1907.—Central Technical Railway Office formed in Berlin to deal with design and research.

August 1, 1907.—New railway signalling and operating regulations came into operation.

March 1, 1908.—Wurzbach-Unterlemnitz line opened.

1909.—Poppet valve gear introduced on Oldenburg State locomotives.

January 1, 1909.—Palatinate Railways taken over by the Bavarian State.

July 6, 1909.—Sassnitz-Trälleborg (Sweden) train ferry opened.

First State Railway Electrification

May 29, 1910.—First State Railway electrification in Germany; Berchtesgaden-Königsee (Bavaria).

March 1, 1913.—Prusso-Oldenburg Agreement regarding the construction on the Neustadt (Holstein) Schwartau line.

September 14, 1913.—New Baden terminus at Basle opened.

October 23, 1913.—New passenger station at Karlsruhe opened.

August 16, 1915.—Hindenburg bridge across the Rhine at Rüdesheim opened.

October 1, 1915.—Opening of new Leipzig Central station.

August 1, 1916.—Electric working inaugurated, Salzburg-Freilassing-Bad Reichenhall.

November 24, 1916.—Mitropa Sleeping and Restaurant Car Company founded.

August 15, 1918.—Kronprinz-Wilhelm bridge at Neuwied-Coblenz opened.

March 10, 1919.—Agreement concludes between the Reich and the eight former railway owning countries for the transfer of their systems to the nation.

January 2, 1920.—By State Decree, inspection of the railways was transferred from the National Railway Office to the Minister of Transport.

January 9, 1920.—Foundation of the Ministry of Transport.

January 10, 1920.—Inter-allied Order divides the Divisional Management of Saarbrücken into two (Saarbrücken and Trier).

January 10, 1920.—"Eastern" Divisional Management formed, to deal with lines which needed regrouping on account of the corridor.

April 1, 1920.—Introduction of graduated scale of freight rates.

Formation of Reichsbahn

May 5, 1920.—Original separate State railway systems merged to form the Reichsbahn with effect from April 1.

December 1, 1920.—Uniform freight charges on German railways.

July 6, 1922.—Uniform title "Reichsbahndirektion" adopted for all general and divisional managements.

October 22, 1922.—New Central station at Stuttgart opened.

Pioneer German Railway Closed

November 1, 1922.—The first German railway, between Nuremberg and Fürth, closed. (See also September 10, 1927.)

January 1, 1923.—International Passenger and Goods Vehicle Association regulates the use of such vehicles.

January 11, 1923.—Owing to occupation of the Ruhr by French and Belgian troops, the operation of the State Railway in that area was discontinued.

February 7, 1923.—Trier Divisional offices occupied by French and Belgian troops.

March 1, 1923.—Rottleberode-Stolberg line opened (Harz Mountains).

June 1, 1923.—FD. trains introduced.

August 7, 1923.—Lithuanians occupy the Memel territory lines.

September 1, 1923.—Electric traction Lauban to Görlitz.

February 12, 1924.—Emergency decree to establish the German State Railway as a separate undertaking.

February 16, 1924.—A Conference at Mainz formulated a *modus vivendi* between the State Railway Administration and the Franco-Belgian Railway "Régie."

August 30, 1924.—State Railway Law came into force.

September 27, 1924.—Reichsbahn Board of Management set up in Berlin.

October 11, 1924.—Right to operate the lines transferred to the German State Railway Company.

November 16, 1924.—Railways worked by Franco-Belgian "Régie" restored to the State Railway. Restoration of the Trier Divisional Administration.

January 11, 1925.—Reichsbahn agreements with Hamburg regarding the Billwärder shunting yards and the Bille-Norderelbe goods avoiding line.

March 1, 1925.—First co-ordinated road motor goods services established between Cochem and Briedern, and Bullay and Bad Bertrich.

May 12, 1925.—International agreement on railway passenger and goods traffic.

May 30, 1925.—Germany subscribes to international agreement on goods traffic.

July 1, 1925.—Reichsbahn absorbs North Brabant German Railway between Wesel and the frontier of Holland.

October 1, 1925.—First gravity yard with hydraulic brakes opened at Hamm, Westphalia.

January 7, 1926.—Train telephony introduces.

November 1, 1926.—Tourist and information office opened in London.

May 1, 1927.—24-hour clock introduced on the State Railway.

Ludwigsbahn Electrified

September 10, 1927.—Former Ludwigsbahn between Nuremberg and Fürth reopened for high speed electric traction.

October 1, 1927.—Co-ordination of railway and airway parcels traffic.

January 28, 1928.—Electrification on Königszelt-Breslau line.

February 20, 1928.—First high-speed a.c. electric railcars introduced on Leipzig-Halle and Leipzig-Dessau-Magdeburg lines.

April 3, 1928.—Electrification of Lauban-Kohlfurt line in Silesia.

April 27, 1928.—Electric traction inaugurated between Munich and Salzburg.

May 15, 1928.—Rheingold train *de luxe* (with Pullman-type coaches) introduced.

June 11, 1928.—First electric train on the Berlin City Railway (Potsdam-Erkner).

September 1, 1928.—Co-ordination of railway and airway passenger traffic ("Fleiper").

October 7, 1928.—Two class system adopted for ordinary trains.

September 19, 1929.—New Königsberg Central station opened.

June 21, 1931.—First experimental journey by airscrew-propelled railcar.

October 1, 1932.—First multiple row power signal frame at Duisburg.

December 9, 1932.—Electrification of the line from Hirschberg (Giant Mountains) to Schmiedeberg and Landeshut (Silesia).

Der Fliegende Hamburger

May 15, 1933.—Electric traction inaugurated on the Wannsee Railway. Flying Hamburger railcar placed in regular service.

May 30, 1933.—Electric traction inaugurated throughout the Augsburg-Ulm-Stuttgart line.

June 27, 1933.—Law passed for the construction of a system of arterial roads.

August 25, 1933.—Company formed to construct the arterial roads.

September 1, 1933.—Revised operating rules issued.

September 23, 1933.—First sod of the arterial roads cut near Frankfort-on-Main.

October 1, 1933.—Separate general management for Bavaria abolished.

November 1, 1933.—Central Technical and Research Office for Bavaria inaugurated at Munich.

March 1, 1935.—Return of the Saar Railways to Germany.

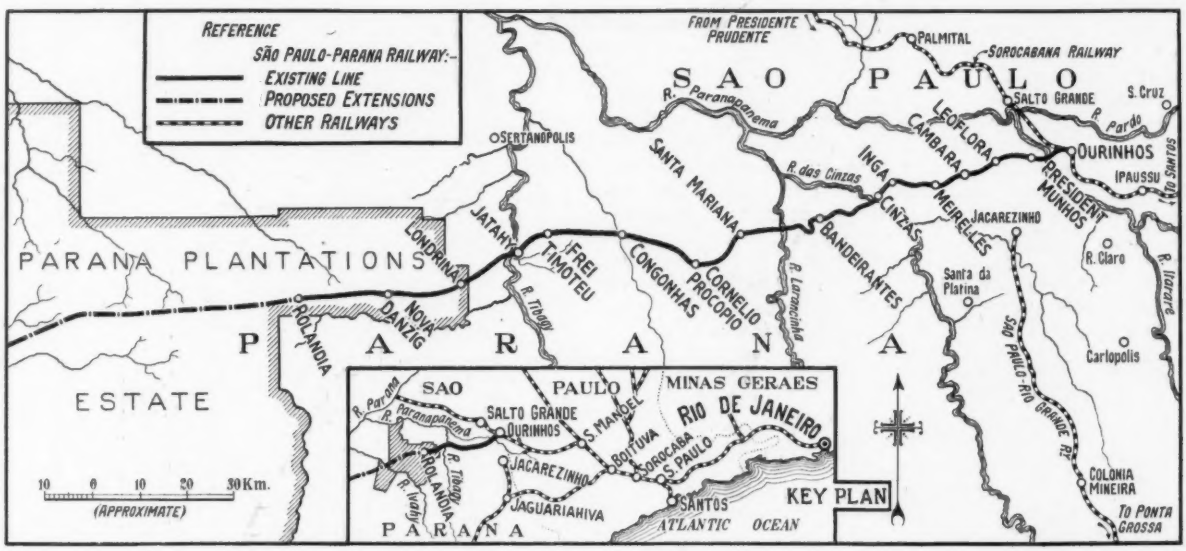
THE RAILWAY GAZETTE
READ WHEREVER THERE ARE RAILWAYS

XUM

NEW METRE-GAUGE LOCOMOTIVES FOR SOUTH AMERICA

Large two-cylinder 2-8-2 type engines built by W. G. Bagnall Limited, Stafford, for the São Paulo-Paraná Railway

TWO 2-8-2 locomotives, with eight-wheeled bogie tenders, have recently been designed and built by W. G. Bagnall Limited, of Castle Engine Works, Stafford, to the requirements of Mr. C. G. Hodgson, O.B.E., Consulting Engineer, London, for the São Paulo-Paraná Railway Company, a subsidiary of Parana Plantations Limited. An article illustrating and describing this railway as then constructed appeared in THE RAILWAY GAZETTE for May 15, 1931. It may be explained, however, that the line was built to provide an outlet to the sea for the Paraná estates by giving a connection to Santos via the Sorocabana Railway from Ourinhos. Although the concession for the line was obtained in 1927, it was not until the middle of last August that the objective was reached by the opening of the bridge across the River Tibagy at Jatahy and the inauguration of through traffic to Londrina, the first station in the estates. By the middle of November the line was open for traffic to Nova Danzig, and construction is now complete to Rolandia (236·5 km. from Ourinhos). Further extension westward through the estates is projected.



Map showing route of São Paulo-Parana Railway

The new locomotives which rank among the largest built for the metre gauge weigh, in working order complete with tender, 95½ tons. They have been designed to run on 60-lb. rails and to negotiate minimum curves of 333-ft. radius, hauling trains of 400 to 500 tons on grades of 1 in 55 at 15 m.p.h. The boiler is large with a wide firebox, and a large grate area is provided for burning wood fuel. The interior firebox is built up of best firebox quality steel plates and the water space and roof stays are of Dunic steel supplied by Samuel Fox & Co. Ltd., of Sheffield. The Edwards patent superheater header is fitted for cutting out the superheater section at will by means of a by-pass valve operated outside the smokebox and passing saturated steam direct to the cylinders in the event of the superheater elements blowing steam. The Melesco superheater elements are arranged in 21 flue tubes 5¼-in. outside diameter and there are 104 small tubes of 2-in. diameter outside. The smokebox has a system of deflector plates and wire netting forming a spark arrester, and also contains a self-cleaning arrangement. In addition a soot ejector is placed in the bottom of the smokebox and operated by a steam cock from the side of the footplate. Distribution of steam to the brake ejector, steam brake valve and other fittings is effected from a steam stand having an emergency shut-down master valve to isolate the fittings from the steam pressure. There are two No. 9 Gresham & Craven Simplex injectors delivering to a top feed clack box and a Worthington-Simpson horizontal duplex double acting pump is used. Other controls operated on this stand are the whistle and turbo-generator, the whole being conveniently placed for the driver's manipulation. Two 2½-in. Ross pop safety valves are mounted on the firebox casing and a warning bell is carried on top of the boiler, this being operated from the footplate. The regulator valve located in the steam dome is of the Owen's patent type. The boiler is lagged with Newlite asbestos blocks and covered with blue planished steel clothing plates. The ashpan is of the self-dumping hopper type with a bottom discharge door conveniently operated by a lever from the footplate.

The main frames are of the orthodox plate type 1 in. thick, stayed by steel castings and widened behind the trailing wheels by a supplementary rear frame 1½ in. thick to accommodate the wide firebox and trailing two-wheeled truck. A girder steel casting braces the two frames together, and an additional reinforcement against draw

and luffing stresses is provided by the continuance forward of the rear frame over the trailing wheels and its attachment to the main frame. The front truck is of the swing link central type and the hind one has a forged steel radial arm and is of a distinctive type providing for the loading on the springs being constantly carried centrally on the axle bearings.

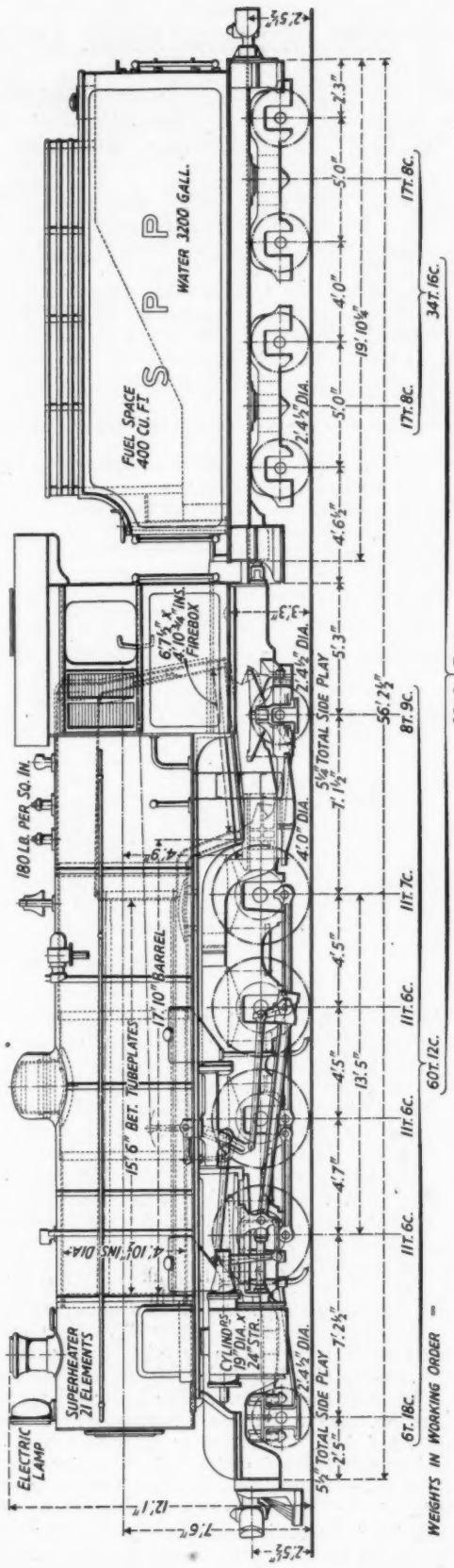
Oil lubrication is provided for the truck and main axleboxes and the spring gear is compensated throughout in two groups, the leading truck, leading and intermediate coupled wheels forming one group and the driving and trailing wheels with the trailing truck forming the other group. Steam distribution is effected by piston valves of the inside admission type, working above the cylinders. Hydrostatic lubrication is applied to the cylinders, needle lubrication on the coupling and connecting rods, and syphon lubrication for the other motion parts.

The cab is wide and of spacious design with a good look-out for the driver. Seats are provided on each side of it and the regulator handle, which is of the cowhorn type, can be operated by the driver whilst in a sitting position with a clear and unobstructed vision ahead. The vacuum brake is fitted with a 30-15-15 ejector and graduable steam brake valve arranged for operating the steam brake on the engine and vacuum brake on the tender and train. The tender is also provided with hand brake. The electrical equipment, supplied by J. Stone & Co. Ltd. of London, embodies a turbo-generator 500 watts, 24 volts, supplying current to a 14 in. diameter headlamp with tail cab and inspection lamps. The Sharon top operating type of central coupler is fitted and supplied by Francis Theakston & Co., London.

The following are the principal dimensions:—

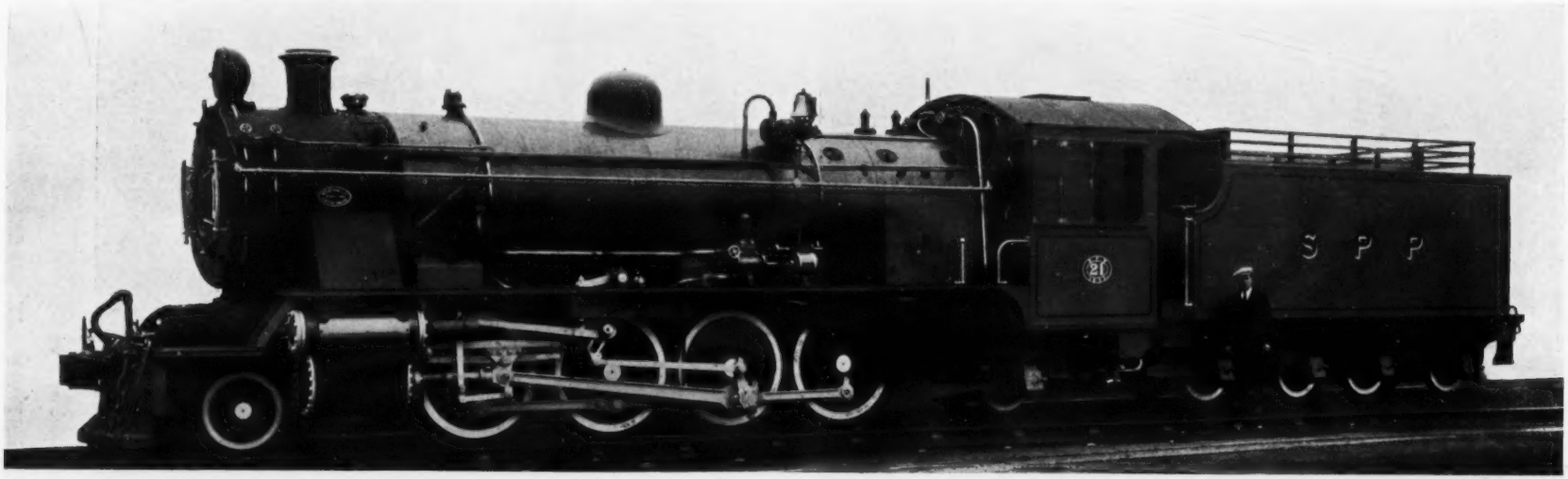
Cylinders (2), diam.	19 in.
Piston stroke	24 in.
Wheels, coupled, diam.	4 ft. 0 in.
,, ,, leading and trailing bogies, diam.	2 ft. 4½ in.
Wheelbase, rigid	13 ft. 5 in.
,, engine, total	27 ft. 9 in.
,, engine and tender, total	51 ft. 6½ in.
Length of engine and tender overall	60 ft. 9 in.
Boiler Heating Surface:	
Small tubes, 104 } Large tubes, 21 }	1,290 sq. ft.
Firebox	154 ,,
Total	1,444 ,,
Superheater	322 ,,
Combined total	1,766 ,,
Working pressure	180 lb. per sq. in.
Grate area	32·33 sq. ft.
Tractive effort at 85 per cent. of boiler pressure	27,616 lb.
Ratios	
Ratio of adhesion	3·66
Evaporative heating surface : Grate area	44·6 to 1
Firebox heating surface : Grate area	4·78
Tractive effort : Evaporative heating surface	19·15

The engine in working order weighs 60 tons 10 cwt. and the tender, which has a fuel capacity of 400 cu. ft. and a water capacity of 3,200 gallons, 34 tons 18 cwt., a total for engine and tender together and in working order of 95 tons 8 cwt. The adhesion weight is 45 tons 4 cwt. The locomotives and tenders have been dismantled and packed and shipped to Santos, South America.

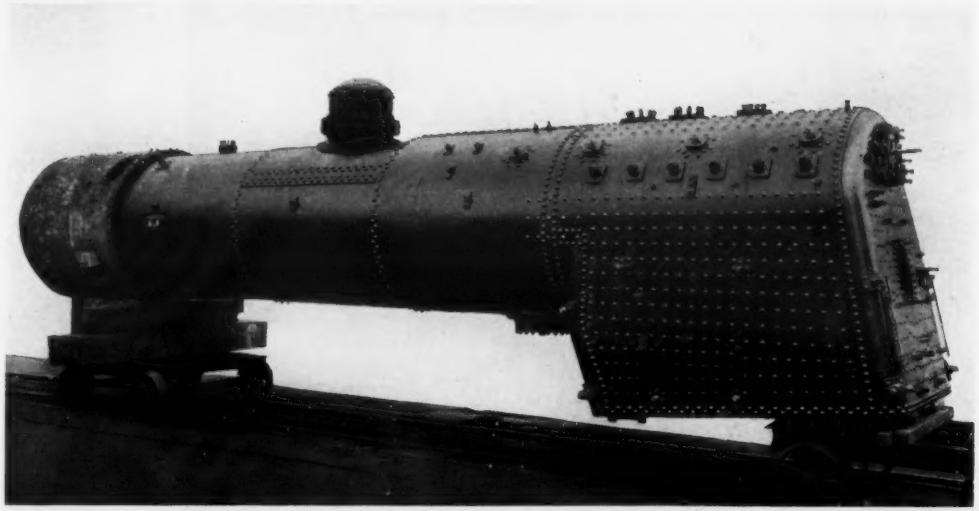


Drawing showing overall dimensions and weight distribution of engine and tender

URUGUAY RAILWAYS AND CO-ORDINATION.—A memorandum establishing the bases of an agreement for supplementing the principal main-line services of the British-owned Central Uruguay Railway and its extensions by motor-coaches provided by the State Railways has been initialled in Montevideo by the Minister of Public Works and the General Manager of the railway.



General view of one of the locomotives



At the Stafford works of W. G. Bagnall Limited. (Left) in the erecting shop and (right) the boiler

NEW 2-8-2 LOCOMOTIVES FOR THE SÃO PAULO—PARANA RAILWAY, BRAZIL

Main entrance and view from street of new L.M.S. research laboratory

The metallurgical and chemical laboratory

THE NEW L.M.S. RESEARCH LABORATORY AT DERBY

THE NEW L.M.S. RESEARCH LABORATORY AT DERBY

A notable step in the development of the Research Department of the London Midland & Scottish Railway is the completion of an up-to-date and centrally situated laboratory

THE various sections of the L.M.S. Research Department* have now been brought under one roof. Each possesses well defined spheres of activity, particularly in regard to what may be termed routine work, but in many research investigations co-operation is essential, and this will be greatly facilitated by their being housed together.

The metallurgical section, under Dr. Hugh O'Neill, is concerned with investigations relating to the selection and manipulation, by casting, forging, heat treatment, welding, &c., of metals used throughout the railway, and for the metallurgical examination of materials that have failed to give satisfactory performance in service.

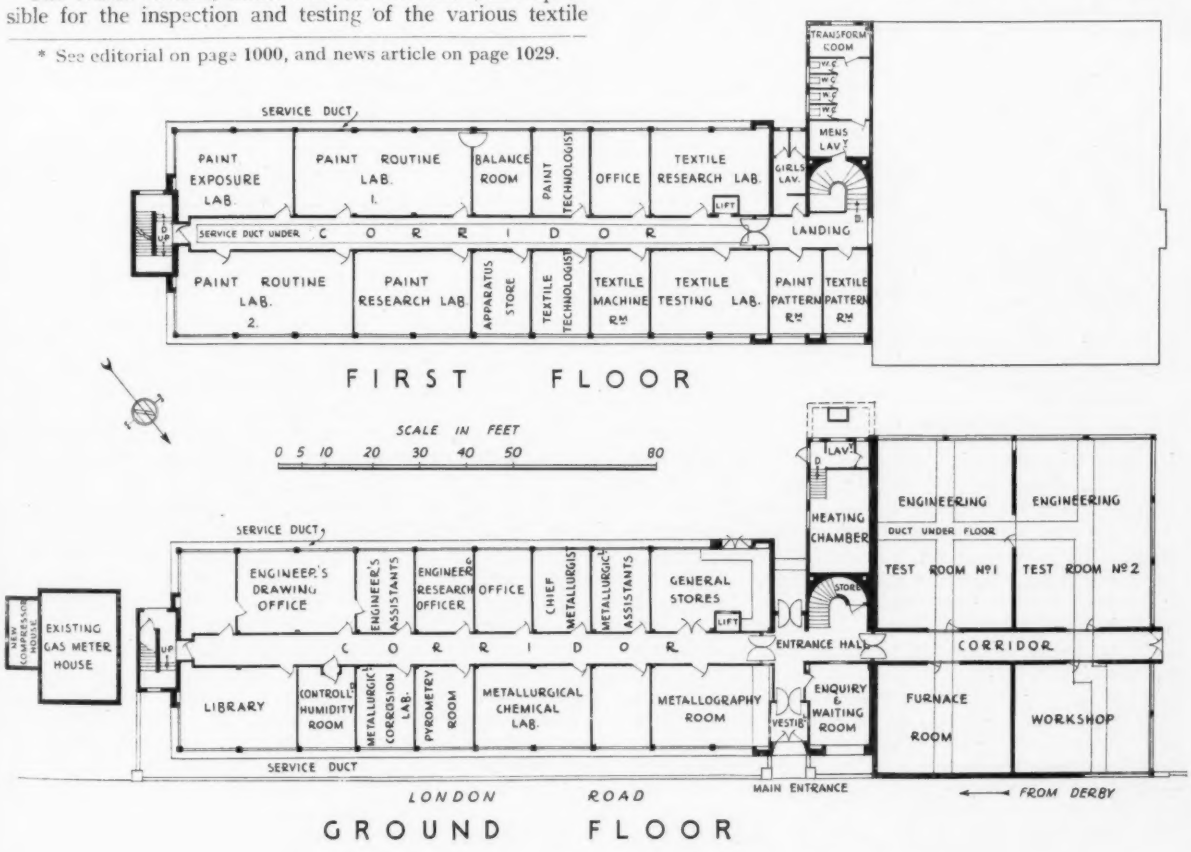
The engineering section, under the direction of Mr. F. C. Johansen, deals with research on the design and performance of engineering details of machines and structures, and with the mechanical properties of materials in relation to service requirements. It is also responsible for the investigation into the mechanical aspects of failures of materials in service and for the study of aerodynamical problems connected with the air resistance of trains, wind pressures, ventilation systems, &c. The work is carried out partly in the laboratory and partly, with the co-operation of other departments, in the field.

The textile section, under Mr. W. Pritchard, is responsible for the inspection and testing of the various textile materials purchased by the company, and for drawing up specifications controlling their quality. This routine work is on a considerable scale, some 8,000 complete tests being carried out each year. In addition, investigations into performance are carried out in the laboratory and in the field, and research on new materials and processes are required from time to time.

The paint section is under the supervision of Mr. F. Fancutt. Like the textile section, it is responsible for the specification and testing of paint materials, some 4,000 samples being dealt with each year. It is also concerned with the routine control of the manufacture of paint and varnish cleaning agents. It co-operates with other departments on questions relating to the choice of materials and methods of application, and it conducts research on improved materials, new methods of testing and better methods of application. For the purpose of easy control, the work is carried out by three subsections, one concerned with routine work, another with application and exposure records, and a third with research.

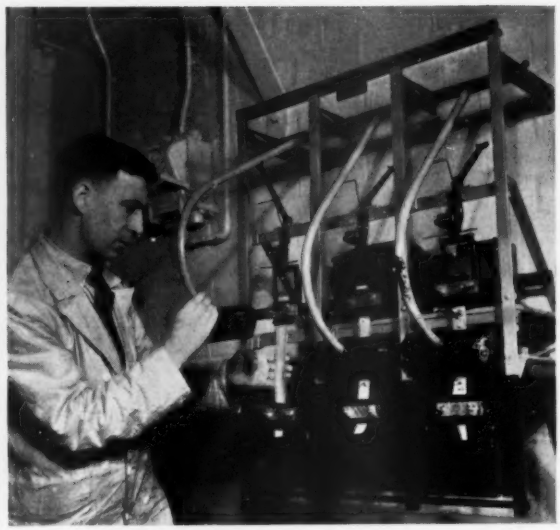
Problems for research arise in a variety of ways: from the deliberations of the advisory committee, through the chief technical officers and at the suggestion of the Re-

* See editorial on page 1000, and news article on page 1029.



Plans showing arrangements of the new L.M.S. research laboratory

Metallography room, with Vickers projection microscope



Wear-resisting machine in textile section

search Department. The more important and extensive investigations, wherever they arise, are discussed in the first instance by the advisory committee, which makes recommendations as to the general lines of attack, and on the question as to whether the work should be undertaken in the company's laboratories or in some outside institution. Less important investigation are put in hand on the authority of the Director of Research or Research Manager, and the results, if of sufficient interest, are reported to the committee on completion. Individual members of the committee are frequently consulted on these minor problems.

Industrial research can prosper only if there is a two-way traffic in ideas. There must be complete confidence between the scientific staff in the laboratory and the manufacturing or operating staff outside. It was to encourage this co-operation that the new laboratory was located at Derby in close proximity to the locomotive and carriage and wagon works. In this way developments in the laboratory can be readily tried out on the full scale in the works, whilst on the other hand difficulties arising in the works can quickly be brought to the laboratory for study and solution.

The New Laboratory

The new laboratory is adjacent to the carriage and wagon works of the Chief Mechanical Engineer's Department, and has a frontage on the south-west side of the main Derby and London Road, with rail siding access adjacent. The site is about 2 miles from the centre of the town and ¾ mile from the L.M.S. station.

The building was designed by Mr. H. J. Connal, F.R.I.B.A., of the Chief Engineer's Department, and consists, south-east of the main entrance, of a two-storey laboratory block, structurally designed to permit the addition of another storey when required, with an engineering test room and workshop block, having a north light open roof, north-west of the main entrance.

The laboratory block has a total floor area on each floor of about 5,600 sq. ft. and the engineering test room and workshop block occupies an area of 3,500 sq. ft. The buildings are constructed on a steel frame principle, and the floors and roof flats to the laboratory block are of reinforced concrete. Every effort has been made to ensure that the premises are fire resisting to the greatest possible extent. The main corridor walls to the laboratory block are in brickwork, and the cross partitions in movable metal-faced cork-insulated slabs. All internal partition walls in the engineering test room and workshop block are in brickwork. The internal doors throughout are also metal faced and hung on pressed metal frames.

The ground and first floors of the laboratory block are planned on a unit system, each unit being 11 ft. 9 in. wide by 16 ft. in depth, and the various laboratories and other rooms therefore comprise one or more units as necessary. By this system of planning it has been possible to arrange for all units to have window area to their full width, thereby ensuring the fullest possible amount of natural lighting and ventilation.

The artificial lighting has also been carried on the unitary principle, a central fitting providing diffuse general lighting of an average level of 7 foot candles, whilst additional illumination is provided on the benches, drawing tables, machines, &c., by adjustable fittings.

The main services, i.e., gas, compressed air, hot and cold water, heating and drainage are accommodated in a duct running the full length of the laboratory block on both sides, arranged for easy access to the pipes. The services to the engineering test room and workshop block are, generally, accommodated in underground trenches, all of which are readily accessible.

The heating throughout is on the low pressure accelerated hot water system through ceiling panels, and the domestic hot water supplies are from the same boilers in an underground heating chamber.

Special care has been taken to isolate the engineering test room and workshop block in the main building by the introduction of cavity walls and special cork insulation to avoid the transmission of vibration throughout the laboratories.

The floor coverings have received special consideration, that in the laboratory block being of specially prepared red coloured asphalt, and in the engineering test room and workshop block, pre-cast concrete slabs made of a size to permit easy movement.

The only decorative treatment in the building other than plain paintwork is confined to the main entrance and staircase where the floors are paved in terrazzo, the

walls having a dado of the same material. Externally the architectural treatment is in multi-coloured bricks with reconstructed stone dressings.

The general contractors were Greenwoods (Mansfield) Ltd., Mansfield, and the furniture and laboratory fittings were supplied by F. Jackson & Co. Ltd., Manchester.

The general arrangement of the accommodation is shown on the plans reproduced, and some notes on the equipment are set out below.

In the metallography room, where metals are microscopically studied, the photomicrographs are taken on a large Vickers projection microscope. A Zeiss workshop microscope is provided for bench work, and there are dark rooms and the usual polishing and etching apparatus. X-ray and electron diffraction apparatus, as well as a spectrograph, will be installed in Room 2 when required. In the chemical laboratory there is a thermostatically controlled Hearson electric oven. Besides the preliminary chemical investigation of materials, the macro-etching of ingots and forgings and the production of fluxes and experimental electrodes are carried out here.

The main equipment in the pyrometry room is a Tinsley thermo-electric potentiometer with galvanometer and Cambridge chronograph. A 3½ kW. Silit high temperature and various electric tube furnaces are available for heating specimens, whilst a Hyvac oil pump enables this to be done *in vacuo*. A Cambridge thread temperature recorder is also to be available, and provision has been made for connecting it by leads to apparatus in other rooms. In the constant temperature and humidity room, where strength tests on textiles are carried out under conditions of constant relative humidity, a Services type of humidity control apparatus is installed. The tests are carried out on Goodbrand testing machines. Room No. 7 is the library, in which a librarian translator is available. The drawing office is in Room No. 9.

In the workshop block the equipment in Test Room No. 1 (engineering section) comprises standard machines requiring no detailed references. There are a Wöhler fatigue testing machine, a modified Haigh electro-magnetic fatigue testing machine, a 15-ton Buckton machine, an Izod pendulum, a Brinell machine, a Vickers diamond pyramid indenter, and a Firth hardometer; as well as a variety of small apparatus including certain instruments designed for specialised field work, such as an instrument for measuring rail wear, corrugation and dip at rail joints; an accelerometer for measuring maximum impact accelerations, and a statistical deflectometer for recording spring deflections. In the second test room are the larger continuous running machines. They are, so far as possible, mounted on rubber and rest on the tiled floor without permanent foundations in order to reduce noise and vibration, as well as for possible future rearrangement.

Two machines, designed by the engineering section, are of particular interest. In one of these, a wear testing machine, two annular specimens can be rotated under forced peripheral contact at varying speeds and degrees of surface slip. The other machine, for studying the nature of the wear of rails and tyres, simulates a pair of wheels which revolve in contact with a rotating track. An electric motor drives the wheels, and power is taken by a generator driven by the track. In addition to studying wear problems, the machine is used for measuring wheel slip, and frictional and derailing forces under known applied conditions.

Room No. 18 is a well equipped workshop for the preparation of test pieces and the manufacture of instruments, apparatus and testing machines. The furnace room contains a 35 kVA high frequency spark gap induction melting furnace complete with ingot moulds and a small gas furnace for heating the feeder heads. There is also a 2½ kVA resistance furnace. Heat treatment is conducted in a 14 kVA furnace with automatic recording temperature control, whilst a 9 kVA furnace with automatic control up to 1,350° C. is provided for high temperature work. A circulating air tempering furnace, taking 4 kVA and thermostatically controlled from 100°-700° C. is also available, and weighing machines, quenching tanks, &c., complete the equipment. For sand testing there are a Simpson-August mill, a Speedy moisture tester, shakers, gas permeability and ramming apparatus and a compression strength testing apparatus.

On the first floor are the textile testing and research laboratories and textile machine room, containing, besides the necessary facilities for textile tests, a washing machine for studying laundering problems.

On this floor are the paint research, paint routine and paint exposure laboratories. In the last, accelerated tests are carried out in a weatherometer which produces in five weeks results comparable with those of 12 months outdoor exposure. Both the paint and textile sections are provided with pattern rooms.

A small atmospheric wind tunnel of the enclosed type, having a rectangular working section 4 ft. 6 in. wide by 3 ft. 6 in. high, has been designed and installed in the paint shop in the locomotive works. It is operated by a motor-driven two-bladed air-screw giving air speeds up to 100 ft. a second.

New Hump Yard at Hull, L.N.E.R.

(*See illustrations on page* 1022)

A NEW hump marshalling yard was brought into use by the London & North Eastern Railway last Monday at Hull for the marshalling of wagons arriving at that city. The yard is designed to deal with 2,500 wagons a day and will be used to sort the traffic for its varying destinations at the docks and goods stations of the third port of Britain.

Four Frölich hydraulic rail brakes have been installed at the hump to control the speed of the wagons in their descent so as to bring them carefully to rest in their respective marshalling sidings. These brakes work on the same principle as those which have been in successful operation for 6½ years at the Whitemoor yard of the L.N.E.R. near March. They are controlled from a central control tower from which also the points are worked. The control tower is of modern design and carried on 15 reinforced concrete piles each 20 ft. long. Three sides of the control tower have glass walls so that the controllers may have an uninterrupted view of the whole yard. The control desk carries a diagram of the area and the operations are carried out by the controller by means of electro-pneumatic buttons. Provision is made in the yard for dealing with livestock, and there are separate departure lines for locomotives, which are thus kept clear of the marshalling movements. At night the whole yard is floodlit.

The construction of the yard has involved the dumping of 7¼ million cu. ft. of filling, all of which was obtained from a quarry in the side of a railway cutting 60 ft. deep at Kirk Ella, five miles away. In preparing the site the Fleet Drain was diverted for a length of 230 yards, entailing 135,000 cu. ft. of excavation. In the yard itself the total length of permanent way is 24¾ miles, of which point and crossing work accounts for five miles. The total length of the new yard is 2 miles 9 chains, and standage is provided for 2,700 wagons in two main groups of six reception sidings and 30 marshalling sidings.

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Above: The inwards yard looking up the hump. Below: General view of this yard from above the hump
NEW HUMP YARD AT HULL, L.N.E.R. (*See article on p.* 1021.)

RAILWAY NEWS SECTION

PERSONAL

Mr. A. E. Tattersall, Signal and Telegraph Engineer, North Eastern Area, L.N.E.R., has been appointed Signal and Telegraph Engineer, Southern Area, in succession to Mr. F. Downes, who will shortly retire from the service under the age limit.

L.M.S.R. APPOINTMENTS

The directors have approved the following appointments:—

Chief Commercial & Chief Operating Managers' Departments

Mr. R. C. Flowerdew, Assistant to District Goods and Passenger Manager, Sheffield, to be Stationmaster, Preston.

Mr. J. B. Dunkley, Head Office Inspector (Staff Superintendent's Office), Derby (located at Euston), to be Stationmaster, St. Pancras.

Chief Commercial Manager's Department

Mr. E. L. Rowley, Assistant to District Goods and Passenger Manager (Passenger), Barrow, to be Assistant to District Goods and Passenger Manager (Passenger), Sheffield.

Mr. T. D. Slattery, Senior Outdoor Representative, New York, to be Assistant to District Goods and Passenger Manager (Passenger), Barrow.

Chief Operating Manager's Department

Mr. P. McCallum, District Locomotive Superintendent, Crewe, to be Assistant to Supt. of Motive Power, Euston.

Mr. W. E. Blakesley, District Locomotive Superintendent, Bescot, to be District Locomotive Superintendent, Crewe.

Mr. H. Hughes, District Locomotive Supt., Carnforth, to be District Loco. Supt., Bescot.

Mr. J. Briggs, Assistant District Locomotive Superintendent, Edge Hill, to be District Locomotive Superintendent, Carnforth.

Mr. R. J. Spencer, Assistant, office of Superintendent of Motive Power, Euston, to be Assistant District Locomotive Superintendent, Edge Hill.

Mr. W. H. Telfer, Assistant District Controller, Bletchley, to be Assistant District Controller, Wakefield.

Mr. T. H. Wakefield, District Controller, Cudworth, to be District Controller, Toton.

Mr. E. Pilgrim, District Controller, Staveley, to be District Controller, Cudworth.

Mr. J. H. Storey, Assistant District Controller, Toton, to be District Controller, Staveley.

Mr. Charles Sydney Page, who, at his own request, is retiring on December 31, after 49 years' railway service, from the position of Chief Docks Manager, Cardiff, G.W.R., joined the former North Eastern Railway in 1886 as a clerk in the General Goods Manager's office, where he remained for four years, before being promoted to the General Manager's office. Before he was 20 years of age he became personal clerk to the General Manager, Sir George Gibb, a position he held for nine years, until he was appointed Chief Clerk to the District Goods and Docks Manager at Hull. Subsequently he became successively Assistant Yardmaster, Yardmaster, and finally Assistant Divisional Goods Manager there in 1907. Three years later he was promoted to be Goods and Mineral Manager for the York and Leeds District. In 1913 Mr. Page was appointed District Superintendent at Hull, a post he occupied for seven years, and one which included responsibility for railway and docks movements and the loading and discharging of vessels also. The wide and practical experience gained by Mr. Page on the North Eastern Railway led to his being invited to the position of Assistant General Manager of the Cardiff Railway, the owners of all the Cardiff docks, and he took up this post in 1920. On the amalgamation of the South Wales docks and railways with the Great Western Railway in 1922, Mr. Page became Assistant Chief Docks Manager, G.W.R. It was in April, 1926, that he was promoted to be Chief Docks Manager, the position from which he now retires. In 1927 the previously separate Marine Department was brought within the ambit of the Chief Docks Manager's authority, so that, since then, Mr. Page has had control of the G.W.R. fleet, including the Fishguard-Rosslare and Weymouth-Channel Islands cross-channel steamers, passenger and cargo, and also a number of tenders used for meeting ocean liners at Plymouth. He is a member of the Government's Standard Advisory Committee in connection with the Port Transport Industry—dealing with questions of registration and decasualisation of port labour—and of the board of management of the Railway Benevolent Institution. He is also a gold-medallist of the Institute of Transport for contributions on water transport. (See also leader on page 1001).

Mr. C. S. Page,

Chief Docks Manager, G.W.R., 1926–35

Mr. H. E. Allwood, M.I.Loco.E., has been appointed Acting General Manager, Sierra Leone Government Railways—in addition to his substantive appointment of Chief Mechanical Engineer—during the leave of Mr. F. E. M. Bentley, General Manager.

The Colonial Office announces that Mr. L. B. Freeston, O.B.E., a principal in that department, has been selected as Secretary to the Conference of East African Governors, and Secretary to the High Commissioner for Transport, Kenya-Uganda, in succession to Col. C. W. G. Walker, C.M.G., D.S.O., who is retiring shortly.

We regret to record the death, on December 9, of Sir John Field Beale, K.B.E., J.P., a Director of the L.M.S.R. Educated at Harrow and Trinity College, Cambridge, Sir John rowed in the Cambridge boat in 1898. He was Chairman of Guest, Keen & Nettlefolds Limited, and the Legal Insurance Company and a Director of

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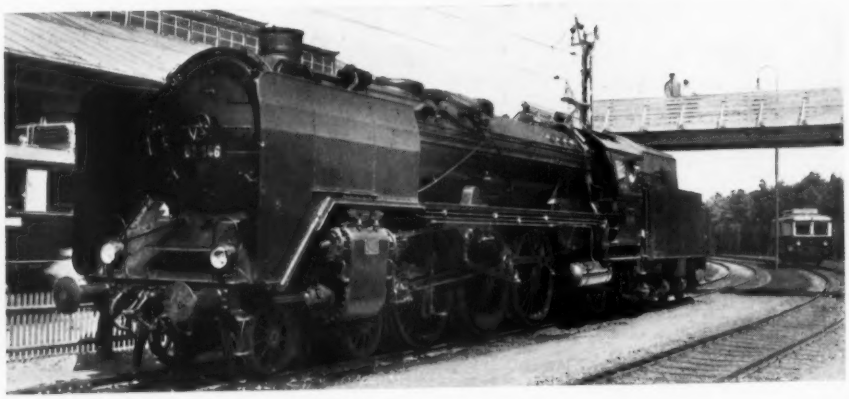
German Railway Centenary

Views at the Nuremberg exhibition which was held from July to October (see article on page 1008). The proceedings last week end are recorded on page 1028

Facsimile of 1835 train headed by "Der Adler"

Entrance to Nuremberg exhibition hall



4-6-2 express locomotive, built by Friedrich Krupp, A.G., Essen, used to demonstrate train control devices; visitors were allowed to ride on the footplate

Permanent way exhibits alongside main hall at Nuremberg exhibition

the Midland Bank. He was awarded the K.B.E. in 1918 and also held Continental decorations. For some years prior to joining the board of the Midland Railway he was senior partner in the firm of Beale & Co., Solicitors to that company.

Mr. D. G. Sullivan has been appointed Minister for Railways, &c., in the newly-formed Labour Ministry of New Zealand.

We regret to record the death, on Tuesday, of Mr. Donald A. Matheson, M.V.O., J.P., M.Inst.C.E., M.Inst.T., former General Manager for Scotland, L.M.S.R., at the age of 75. Earlier he was Engineer-in-Chief, General Manager and Consulting Engineer to the Caledonian Railway. (See also editorial note on page 997.)

Mr. Arthur Mullins, C.M.G., C.B.E., formerly a Director of the Department of Overseas Trade and Commissioner of the Overseas Trade Development Council, has been appointed by the Foreign Secretary and by the President of the Board of Trade to be a second Deputy Comptroller-General in the department in addition to Mr. E. R. Eddison, C.B., C.M.G.

Mr. Clarence D. Smith, Chairman of the Consett Iron Co. Ltd., is resigning the chairmanship, but retains his seat on the board. Mr. Clive Cookson has been appointed Chairman and Mr. Edward J. George, a Director and the General Manager, has been appointed Deputy-Chairman. Mr. Ralph Alsop has been appointed Assistant General Manager, with a seat on the board, but also retains the secretaryship.

Mr. Daniel Willard, President of the Baltimore & Ohio Railroad, created a record on November 25, by retaining the chief executive office of the system for longer than Mr. J. W. Garrett's 25 yr. 10 m. 9 d., the previous longest period. Mr. Willard has 56 years' continuous railway service, having joined the Central Vermont as a platelayer when he left school. Since about 1914 there have been many high posts of honour to which Mr. Willard has been appointed by the Government, by the associated railways, or by private or public bodies in the United States of America.

The Metropolitan-Vickers Electrical Export Co. Ltd. has appointed, as Directors, Messrs. I. R. Cox, H. L. Guy, and G. A. Juhlin, all of whom are members of the parent company's staff.

Mr. Cox served his apprenticeship with the British Westinghouse Company, and was appointed Assistant Turbine Engineer at Trafford Park in 1913. During the war he rose from private to Major commanding a Brigade of Royal Artillery, and saw service in France, Egypt, Palestine and Salonica: he was decorated with the D.S.O. and the Croix de Guerre. From 1919 to 1927 Mr. Cox was Turbine Engineer at Trafford Park, after which he was Chief Electrical Engineer for the Metrovick concern on turbine work in Russia, and subsequently visited Australia and America on business. More recently he has been at the Export Company's headquarters in London. He is an A.M.Inst.C.E.

Mr. H. L. Guy entered the mechanical engineering side of the Metropolitan-Vickers Electrical Co. Ltd., then the British Westinghouse Company, in 1910, and rose to be Chief Engineer of the Mechanical Department of the company in 1921. Since 1928 he has been a Member of Council of the Institution of Mechanical Engineers, and has contributed many technical papers to this and other engineering bodies, and was awarded the Hawksley gold medal of that institution for one of them. Mr. Guy has on three occasions acted on the British Delegation to the International Steam Tables Conference; he is Chairman of the Pipe Flanges Research Committee of the Institution of Mechanical Engineers, a member of the Research Committee of the Institution of Civil Engineers, and a Member of the National Physical Laboratory Advisory Committee for Metallurgical and Engineering Research on Materials.

Mr. G. A. Juhlin, who was born and educated in Sweden, joined the firm of Dick Kerr & Company, Preston, in 1903, remaining there until 1915, as Chief A.C. Design Engineer during the last eight of those years. He joined the then British Westinghouse Company in 1915 and was appointed, two years later, Chief Engineer of their Plant Department, covering the design of the company's heavy electrical products. He is a member of the Institution of Electrical Engineers, and has contributed a number of papers on design subjects to the institution. In 1925 Mr. Juhlin visited the Far East on behalf of the firm.

The late Sir John Pybus, formerly Minister of Transport, has left the residue of his estate to trustees to assist the education and advancement in life of boys and young men of the artisan class under 25 years of age belonging to Hull and Bradford, who in the opinion of the trustees should be so assisted. He left altogether, estate valued at £92,026 (£88,110 net).

Sir Ralph Wedgwood

Sir Ralph Wedgwood, C.B., C.M.G., Chief General Manager, L.N.E.R., is the subject of an appreciation—which we quote below almost in full—in the December issue of *The Railowner*, the official organ of the British Railway Stockholders Union Limited.

"It is probably no exaggeration to say that of all General Managers of recent times the hardest task has fallen to the lot of Sir Ralph Wedgwood, General Manager of the L.N.E.R. since 1923, and Chairman of the General Managers' Conference in 1935. He became General Manager of the North Eastern group in a period not in itself unsatisfactory, but the forerunner of those years which, since 1929, have tested the courage, the inventiveness and the endurance of railway officials as they have not been tested since those early and distant days when railways were a new, speculative and wildly uncertain investment.

"In many respects Sir Ralph is not the typical general manager, or perhaps it would be more accurate to say that he represents the general manager of the future rather than the general manager of the past. At any rate he brings to the affairs of the railways those qualities of mind and experience which are the product of the British Public School and the University, for he was educated at Clifton and Trinity College, Cambridge. In short, his career reflects the modern view which turns to our universities for industrial leadership.

"The L.N.E.R. has probably been more susceptible than any other group to the many factors which in recent times have operated against the companies. Disorganisation in the coal trade, a decline in shipments for overseas markets, new commercial conditions reducing whole areas to unemployment, all these factors have simultaneously attacked this group as though some malignant power were determined to reduce it to bankruptcy. However, the L.N.E.R. has survived. But it has done more than that—while the stockholders were deploring another disastrous year, the company was quietly laying the foundations for new efforts calculated to become effective in the near future. In a letter to the writer a gentleman, exceptionally qualified to express an opinion on such a point, makes the following remark:

> No railway in the world, with the exception of the G.W.R., has calmly carried out its settled policy of 1923–1935 to the extent that the L.N.E.R. has done, but it has required indomitable courage to continue this through the period of British and, later, national crises. Side by side with continuous progress in the calibre of the administration there has been an unremitting effort towards extensive economies and all the time the technique of railway operation on the L.N.E.R. has been improved.

"The London & North Eastern Railway was the first British main line railway to adopt buck-eye couplings, carriage cleaning machines, rail brakes in marshalling yards, train ferries to the Continent, short fishplates, automatic colour-light signals, articulated rolling stock, electric cooking, buffet cars, diesel railcars and ticket-issuing machines.

"To the stockholder, Sir Ralph is possibly best known for a somewhat uncanny ability to deal with the most intricate statistics in a fashion that is both interesting and conclusive. As the spokesman of the four groups

before the National Wages Board in November and December, 1932, he made a reputation in this direction which will be remembered for many years to come. Certainly the stockholders' case was never stated in a more convincing fashion.

"He is said to be the foremost expert in the country on the complex system of railway charges, but unlike so many men who brilliantly marshal figures, he is always able to check his conclusions by practical experience. As Director of Docks in France during the war period, he gained an insight into the relationship of rail and water services that must have proved invaluable to a company that assesses its maritime interests at something like £28,000,000. And again, as President of the National Conference of Employers' Organisations, he gained a grasp of labour problems that is wholly exceptional; but indeed it is difficult to find any branch of railway activity with which he is not familiar in some special sense. If we take electrification for instance, we find that he was a member of the Weir Committee.

"The outstanding characteristics of Sir Ralph Wedgwood are his initiative, and his dogged perseverance, possibly the rarest and most valuable of all great qualities. He is not prepared to dismiss a suggestion merely because it is novel, he is not to be driven from his objective by the vicissitudes of fortune. He holds to an exceptional extent the loyalty and the trust of his officials and his men. In desperately difficult times he has displayed an undiminished faith in his company and in its future. There are those who believe that the day is not far distant when that faith will be justified by the event."

Mr. Howard-Williams on Argentine Railways

Mr. W. Howard-Williams, Chairman of the Central Argentine Railway, arrived in Buenos Aires on November 19. Shortly after arrival, he made the following statement which was published in the press:—

As is already well-known the railway companies in Argentina are experiencing a very delicate financial situation which makes the normal train traffic harder to carry out every day.

I, who love this country very much, having lived here many years and having made many friends here, have returned with the sole object of trying to better the situation, because I am convinced that the normal traffic and service on the railways is indispensable for the well-being and prosperity of the Argentine Republic, since they have done so much in developing the progress reached by this country.

No other object guides me than to find harmony between the public interest and that of the railway proprietors, and to re-establish the traditional atmosphere of goodwill in commercial circles which has always existed between my country and Argentina. For that reason I hope to be able to converse with the country's high authorities and trust to find them well disposed.

Nothing would be more pleasing than for me to be able to return to London able to counteract the adverse propaganda which is at present being made against the commercial relations with Argentina.

British Railway Stockholders' Union Limited

The position of stockholders in relation to the demand by the railway unions for the restoration of the remainder of the wages cuts accepted by them in 1931 was mentioned by Sir Charles Stuart-Williams, Chairman of the British Railway Stockholders' Union Limited, when he presided at the third annual general meeting, held at the Central Hall, Westminster, S.W.1, on December 11.

Moving the adoption of the report and accounts for the year, the Chairman said the claim of the railway unions for the restoration of these reductions was now under consideration, and would presumably come before the newly-constituted National Tribunal. It seemed to them a matter of some importance that the position of the stockholders should be considered, and in particular, the very large sums which they had lost, applying the criterion of the standard revenue laid down in the Act of 1921. A detailed and accurate statement of these losses, prepared by their chartered accountants, amounted to the astonishing total of £97 millions. That meant that the difference between the amounts received in dividends by the stockholders of the four systems during the five years ended December 31, 1934, and that which they would have received had the standard revenue been attained, amounted to £31·89 millions in respect of preference and preferred stocks, and £65·9 millions in respect of ordinary and deferred stock, making a total of over £97 millions. They could only hope that the Wages Tribunal would take these facts into consideration.

Regarding the question of local rating on which the decision of the House of Lords was awaited, he had seen in certain financial papers what seemed to him an optimistic estimate of the possible result of a favourable decision. The question was one of extraordinary complication, and while, perhaps, they had some reason for optimism, he thought their hopes should be kept within reasonable limits.

Referring to the ascertained and estimated results of railway workings for 1935, the Chairman said that up to the present the dividends declared had followed precisely the same lines as those for 1934, save that the L.M.S.R. had, in respect of the final dividend on the 1935 redeemable preference stock, announced at an earlier date than last year its intention to make payment on the due date. At the time of speaking, the receipts of the four groups for the first 48 weeks of the year showed amounts exceeding those of 1934 by the following: G.W.R., £206,000; L.M.S.R., £717,000; L.N.E.R., £155,000; S.R., £188,000 making a total of £1,266,000, which sum was made up of an increase of £1,215,000 on passenger traffic and £68,000 on merchandise, less a decrease of £17,000 on coal traffic. There would be an additional burden for 1935 on account of the partial restoration of the wage cuts for the whole year, and possibly, increased working costs in other directions, so it was obvious that no marked improvement in net receipts could be expected. On the other hand, it was satisfactory that, in spite of reduced fares, there had been a substantial improvement in passenger revenue, together with a definite upward trend in merchandise receipts for the past few weeks.

The motion was seconded by Mr. D. Ross-Johnson, but before it was put to the meeting, a discussion ensued. Mr. W. E. Sutcliffe called attention to a suggestion that the present situation might develop into a state whereby the railway companies existed to give efficient transport in the widest sense, and pay good wages, with the partial elimination of the shareholders' interests. In face of such a terrible situation, he felt there had not been the co-operation between the L.M.S.R. and the L.N.E.R. that was vitally necessary. For instance, before the improvements at Euston station were undertaken, he thought it would be wise to ascertain whether Marylebone station, L.N.E.R., could not be adapted to the service of both companies in order to avoid the tremendous outlay at Euston.

Mr. W. Perritt Taylor said he did not think the fact that railways were the property of stockholders was always fully realised in high quarters. There was an assumption in many people's minds that the first consideration of a railway was to give the employees a good living.

Commander R. T. Bower, after quoting from a speech by Mr. Herbert Morrison in the House of Commons on Tuesday night, said there was a danger that, if at some future date, the railway companies found it possible to pay ordinary dividends, there would be an outcry from highly organised political parties and trade unions that the transport loan had been used to subsidise private profit.

Following the adoption of the report and accounts and the re-election of members of the council retiring by rotation, the Chairman referred to the retirement of Lt.-Col. Frank Hilder from the position of Hon. Treasurer, and a vote of thanks was accorded to him for past services.

LIGHT-METAL FORGINGS. — Light-Metal Forgings Limited has been registered as a private company, with a capital of £100,000 in £1 shares. The first directors not named.

The Organisation of Transport

On Wednesday evening last Mr. Frank Pick, Vice-Chairman, London Passenger Transport Board, read a paper, entitled "The Organisation of Transport with special reference to the London Passenger Transport Board," before the Royal Society of Arts. Mr. John A. Milne, C.B.E., Vice-President of the Society, presided.

Mr. Frank Pick said that the London Passenger Transport Board represented the amalgamation of 165 undertakings, or parts of undertakings. To fit all those independent and irregular pieces together into some ordered whole was almost like a jigsaw puzzle, and after two years it could not be said to be wholly assembled. The London Passenger Transport area was an accident arising out of the way in which the various transport undertakings serving it in the past were affiliated and grouped. It was not a logically defined or conceived area. Some day there might be a further review of the proper area of the metropolis, and such a review was bound to lead to an extension of the present boundaries, for there was a sense in which London and the Home Counties represented a social, economic, and even geographical unity which might require and demand single treatment. These were speculations for the future, but they led up to the point that an aggregation of people in a single social, economic, geographical unit required a single organisation for the discharge of each one of the many objects or functions which it embraced. The higher organisation which co-ordinated all those functions into a whole was left as being almost too debateable for treatment.

Generally speaking, the functions which London served or required had not been dealt with in any comprehensive fashion. The Metropolitan Water Board was far from co-extensive with the problem of the water supply. Gas and electricity were erratically divided and scattered, as the L.P.T.B. sensitively appreciated. Local administration and its related public utility services within the area served by London Transport were in the hands of 353 autonomous or quasi-autonomous bodies. The central government, in a policy of despair probably, managed the bulk of the police force and interfered in road planning and construction to induce some collective action and scheming. Town-planning, so called, did not exist at all. Progress in conceiving and organising London had been unequal and unbalanced. Even the L.P.T.B. was not without its flaw. The suburban services of the main line railways representing 1,023 miles of route, running 273 million car miles, and carrying in whole or in part 547 million passengers, were still dispersed in the hands of the four amalgamated companies. These services represented in car miles 0·34 per cent. of the whole, or in passengers 13 per cent. of the whole. Although there was a standing joint committee of the board and the four companies, to consider their mutual interests it was not the same as a welding of those interests into one. The task of dealing with local passenger transport as a unity, as a specific function of this metropolis, was, however, proceeding under favourable conditions. The Government had taken a decisive interest in its fulfilment, and had agreed to support an expenditure of £40,000,000.

Mr. Pick then proceeded to discuss the evolution of London transport and show its effects on the social and economic development of the growing metropolis. The original London depended on horse transport, and was circumscribed by the capacity of the horse. In those days, there was a ribbon development along the few roads that ran out from London into the country. For example, there was an almost continuous string of villages along the road to the north that runs through Clapton, Stamford Hill, Tottenham, Edmonton, Ponders End, Waltham Holy Cross, and Hoddesdon. The first surburban railway was built in 1836 and ran from Spa Road, Bermondsey to Greenwich. It was the precursor of a network of suburban railways which established new townships out of stagnant villages round about the stations, which sent their working population daily into and out of London. There was still a development by means of growing cells roundabout a railway station nucleus to constitute some organism that was doomed never to be independent—at best a satelite, at worst a parasite.

The horse bus was first organised as a means of transport in 1829, and soon began to fill up the interstices of the nucleated railway development, by occupying all the main roads within a range of four miles from the centre, thus solidifying the inner suburbs and settling the core of London. The tram started as a horsed vehicle in 1861 and became a competitor of the 'bus and accelerated the process of expansion. After passing through various phases of expansion, the underground railway provided an alternative system of railways, with distinct characteristics both of service and fare, stretching out to distances of twelve miles or so from the centre and stimulating the building of houses. So the solid core of London was enlarged maybe more than was healthy or advantageous. Electric traction had, in turn, come to the aid of the main line suburban railway system, and by its greater efficiency opened up a still wider field for suburban growth, so that the immediate sphere of influence of London was an area about fifty to sixty miles across, corresponding fairly closely to the London Passenger Transport area.

Continuing, Mr. Pick pointed out that the internal combustion engine had ousted the horse in the years 1906 to 1911, and the motor bus and coach, covering all roads of any traffic significance throughout the London Passenger Transport Area and even beyond, had occasioned a fresh ribbon development along the main roads leading out from London. This had been condemned indiscriminately because it was misunderstood. The fault was not so much with the development itself, as with its extravagant and wasteful shape, owing to the absence of any real plan. The motorcar was planting villas sporadically over all the countryside without any regard for a reasonable economy in the employment of land, so that the distinction between town and country around London was almost wholly breaking down. This was an even worse abuse than beribbonment. There were about 415,000 motor cars licensed in London and the five Home Counties, or one to every twenty-seven people resident in those areas. All but a small proportion of those motor cars must operate in and about London, and they represented a menace to communal transport. They caused an abuse of street accommodation, and were the main ingredient in congestion. It was questionable whether London could economically support them, when road widenings might cost up to £1,000,000 per mile and the added space might primarily be used for waiting vehicles.

Discussing the undisciplined growth of London, Mr. Pick said he thought that it would be unfair to overlook the efforts made by the Underground Group to remedy the resultant difficulties between 1904 and 1933. It first co-ordinated a main line suburban service with a tube when it linked the underground and the old L.N.W.R. main line at Queen's Park and ran services through from Elephant and Castle to Watford. It first linked one underground railway to another when it joined up Euston and Camden Town, to form a group of railways giving both city and West End services to a series of suburbs. It first commenced running 'bus services as feeders to the underground railways, focussing the routes upon outer terminal or quasi-terminal stations. It first found it expedient to reconstruct the interchange stations to make exchange between line and line easy and speedy. It first realised that stations must be in the traffic centres themselves rather than nearby and set about moving and rebuilding them. For all these works large sums of fresh capital were spent to repair the neglect and waste of the past. For the future, all this had ceased. Transport had become a single service, whatever its form, to be planned and executed as a single whole. This was the advantage which the institution of the L.P.T.B. conferred on London.

Mr. Pick then discussed the limita-

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tions to development involved by speed and cost. At 12 m.p.h., which might be taken as the average speed of street transport, a six-mile range appeared to fix the limit for any mass movement. Cities, therefore, based on tram or bus or trolley, could not expect to grow readily beyond a radius of six miles from the centre.

At a speed of 25 m.p.h., which might be taken as the average speed of local railway transport, the limit was extended to a range of about twelve miles, which fairly corresponded to the built-up zone of Greater London. Main line suburban trains which ran out express to stations beyond that 12-mile zone would build up colonies around their stations, and would establish independent towns such as Brighton and Southend. The prevailing fare charged also governed the scale of an urban transport system. At 4d. the volume of traffic diminished; at 6d. per journey the mass movement was ending. The question, therefore, was how far a passenger could reasonably expect to be carried for 6d. The ordinary fare was no real index; special rates, such as those for season tickets, had to be considered.

If in any one direction speed or fare was exceptionally favourable, then an unwholesome and unfair stimulus was given to expansion in that direction and development was distorted. For that reason programmes for construction had to be related together and kept within bounds, so that the measure of the added facilities was related to the anticipated measure of the increased traffic.

The German Railway Centenary Celebrations at Nuremberg

The celebration of the 100th anniversary of the opening, on December 7, 1835, of the first railway in Germany, between Nuremberg and Fürth, took place at Nuremberg on December 7 and 8. Throughout the year interest in the subject has been maintained by numerous publications and lectures, and in Nuremberg a well-planned railway exhibition, described on another page, was open for several months.

The recent ceremonies, which were held under the special patronage of Chancellor Hitler and were attended by many distinguished guests from other countries, formed a fitting conclusion to the efforts made to show what German railway engineering has accomplished since Stephenson's locomotive *Der Adler* started the little Nuremberg-Fürth line on its many years of usefulness. The Reichsbahn of today, at the end of a century of endeavour, stands in every department of its activities in the forefront of the world's railway systems.

The centenary celebrations began on December 7 with performances by numerous railwaymen's orchestras, and a demonstration on behalf of the winter relief fund under the presidency of Dr. Julius Dorpmüller, General Manager of the German State Railway, and his deputy, Herr Kleinmann, followed in the evening by a great gathering of over 2,000 railwaymen, at which speeches were delivered by leading officials.

On December 8 Dr. Dorpmüller and Sir Josiah Stamp, who was accompanied by Sir Osborne Mance and Mr. R. Holland Martin, to represent the British railways, laid wreaths on the memorial in the Nuremberg Transport Museum in honour of the railwaymen of all countries who fell in the war, after which the foreign guests were officially received. Herr Hitler and members of the Government then presided over the principal gathering of the day, at which Herr Hitler, Dr. Dorpmüller, and the Minister of Transport, Freiherr von Eltz-Rübenach, spoke.

Dr. Dorpmüller paid a particular tribute to George Stephenson, whose first locomotive, he said, had contained the germ of the constructional features of the modern locomotive. He considered that as long as loads to be hauled were of the weight they were today, the railway engine would retain its precedence over other forms of transport. Dr. Dorpmüller mentioned that the Reichsbahn had effected economies totalling over £2,000,000 in the last ten years.

Freiherr von Eltz-Rübenach spoke of the part played by the railway in unifying the German states into a single empire. The way to state control of railways in Germany had been led by Bismarck, for it had become evident that private capital would not construct lines where there was little chance of profit. It was not, however, until after the great war that all the railways had been merged into one company.

Herr Hitler supported Dr. Dorpmüller's view that the railway would continue to be the medium of mass transport, and said that the task of the future would be to co-ordinate the functions of rail, road, and air. The Reichsbahn had proved that a great enterprise could be created without private capital, but he emphasised that it was private enterprise that had laid the foundations upon which the present structure was built. A sense of duty was the driving force behind the service of the Reichsbahn.

The speeches were followed by a parade of locomotives and vehicles on a track laid in front of a large stand in the Nuremberg marshalling yard. The order of procession was as follows:—

1. Ten of the latest standard express locomotives.
2. A full-sized model of the first train on the Nuremberg-Fürth Railway, or Ludwigsbahn.
3. A full-sized model of the locomotive *Die Pfalz* hauling the saloon carriage used by Prince Bismarck.
4. High Speed Locomotives and Railcars:—
   (*a*) Streamlined locomotive built by Borsig, maximum speed 175 km.p.h. (110 m.p.h.), with corridor, restaurant and baggage cars.
   (*b*) Streamlined steam train built by Henschel, maximum speed 175 km.p.h. (110 m.p.h.).
   (*c*) Two-car electric railcar set, maximum speed 160 km.p.h. (100 m.p.h.).
   (*d*) Two-car diesel railcar set, maximum speed 160 km.p.h. (100 m.p.h.).
   (*e*) Three-car set, ditto.
5. Modern Steam Locomotives and Rolling Stock:—
   (*a*) Express locomotive, with corridor, sleeping and Rheingold train saloon carriages
   (*b*) A "mystery journey" special train.
   (*c*) Light semi-fast train composed of tank locomotive and ordinary passenger carriages.
   (*d*) Goods locomotive with large capacity goods wagons.
   (*e*) Goods tank locomotive with ballast and other engineer's department wagons.
   (*f*) Goods tank locomotive with special goods wagons and crane wagon.
6. Diesel locomotive with Voith hydraulic transmission hauling a work train.
7. Electric Locomotives:—
   (*a*) As used for the Karwendel Express.
   (*b*) Express type, hauling construction wagons.
   (*c*) Ordinary passenger type with carriages.
   (*d*) Goods type, hauling beer wagons.
8. Electric Railcars:—
   (*a*) Two-car railcar set, maximum speed 120 km.p.h. (75 m.p.h.).
   (*b*) Eight-wheeled a.c. observation railcar.
9. Self-Propelled Railcars:—
   (*a*) Eight-wheeled diesel-electric railcar and driving trailer.
   (*b*) Eight-wheeled Doble type steam railcar and driving trailer.
   (*c*) Four-wheeled diesel railcar with ordinary trailer.
10. Small motor shunting locomotive.
11. Rail motorcar for inspection work.
12. "Kraft durch Freude" (Power from Happiness) special train with passengers.
13. Reichsbahn Motor Vehicles:—
   (*a*) Express bus for use on the national motor roads.
   (*b*) Diesel motor lorry.
   (*c*) Doble type steam lorry.
   (*d*) Gas-driven lorry.
14. Transporter Wagons:—
   (*a*) Standard pattern wagon.
   (*b*) Self-propelled ditto.
   (*c*) 80-tonne special wagon.
   (*d*) 2 standard pattern wagons with heavy load platform between.
   (*e*) Tip-up wagon.

Colour-light signals were used to control the running of these vehicles, so that if necessary they could be stopped for closer examination. A detachment of railwaymen wearing numerous uniforms of former days marched through the town to the marshalling yard.

In the evening a Christmas ceremony was held in the Market Place of the Christ Child, followed by a reception at the Rathaus of the foreign guests by the Mayor, Herr Willy Liebel, and a performance at the Opera House of Act III of Wagner's "Meistersinger von Nürnberg."

On December 9 the guests, who travelled in a special sleeping car train, arrived in Heidelberg, inspected the national motor road to Frankfort, and then proceeded by special train to Berlin, where they were received by Dr. Dorpmüller. The conclusion of the celebrations took place in the evening at Krolls Opera House, when the Reichsbahn gave a reception to the guests, members of the Diplomatic Corps, and the Government.

Opening of L.M.S. Research Laboratory

The new research laboratory at Derby (described on page 1019), which will house the various sections of the Research Department of the London Midland & Scottish Railway Company, was opened from inside a first class dining saloon on Tuesday, December 10, by Lord Rutherford of Nelson, whose speech was broadcast throughout the train by loudspeakers, and relayed by land line to officials and employees assembled inside the new building.

The special train from St. Pancras to Derby carried a distinguished company of guests, including railway officials, scientists, and representatives of practically every branch of industry. Sir Josiah Stamp, President of the Executive and Chairman of the L.M.S.R., was the host, and the principal guests were :—

Dr. Alec Akers; Lord Ashfield; Messrs. G. H. Loftus Allen, W. S. Graff Baker, W. R. Barclay, G. S. Bellamy, A. F. Bound; Sir William Bragg, Sir Harold Carpenter; Sir Christopher Clayton; Dr. W. H. Coates; Messrs. T. F. Coleman, C. B. Collett, H. J. Connall, F. D'Arcy Cooper; Dr. Lewis Dale; Messrs. G. L. Darbyshire, Ashton Davies, Damer Dawson, W. J. Dawson, J. W. Dulanty; Dr. C. H. Desch; Messrs. A. C. G. Egerton, E. C. Evans, C. E. Fairburn, E. B. Fielden; Col. J. G. Fleming; Sir Henry Fowler; Major F. A. Freeth; Dr. H. J. Gough; Sir Ernest Gowers; Messrs. E. D. Grasett, H. Greenwood, F. Halstead, W. H. J. Hartley; Sir Harold Hartley; Dr. W. H. Hatfield; Messrs. T. M. Herbert, A. L. Hetherington; Professor R. S. Hutton; Professor C. E. Inglis; Sir James Jeans; Mr. J. M. Kirkwood; Sir William Larke; Lt.-Col. A. G. Lee; Sir Harry Lindsay; Messrs. E. J. H. Lemon, W. F. Lutyens, J. H. Maggs, R. E. L. Maunsell; Wing-Commander A. H. Measures; Dr. Harold Moore; Professor G. T. Morgan; Lt.-Col. A. H. L. Mount; Mr. A. Newlands; Sir Archibald Page; Mr. J. G. Pearce; Sir William Pope; Mr. E. Pugson; Professor F. L. Pyman; Messrs. J. Arthur Reavell, W. A. Reid, H. R. Ricardo, J. Rogers; Sir Robert Robertson, Dr. Alexander Russell; Lord Rutherford; Professor Dr. F. Simon; Dr. F. S. Sinnatt; Sir Frank Smith; Dr. T. Swinden; Messrs. J. Shearman, W. A. Stanier, T. E. Thomas, T. H. Turner, D. C. Urie, W. K. Wallace, V. Watlington, E. B. Wedmore, C. G. Williams, B. H. Wilsdon, and C. S. Wright; and Dr. Joseph Yates.

Before the special train left St. Pancras, the locomotive, a new Crewe-built 5X class 4-6-0, was named *Lord Rutherford of Nelson* by Master Pat Fowler, Lord Rutherford's grandson, who was lifted on to the running plate by Sir Josiah Stamp. After he had pulled the cord unveiling the name-plate, calling out the name inscribed upon it, he was presented with a model of the locomotive by Sir Josiah.

Shortly after the journey began, the loud-speaker relay service was switched on in order that Sir Josiah Stamp could extend a welcome to the guests, and explain the arrangements made for separate parties to tour the works and laboratory at Derby. On arrival at Derby, the train was joined by another party of railway officials, and luncheon was served while the train was shunted on to a siding directly opposite the research station.

Sir Josiah Stamp, following the loyal toast, proposed the health of Lord Rutherford, and extended on behalf of the directors and officers of the L.M.S.R. a most cordial welcome to the guests. The presence of representatives from almost every branch of industry, he said, made them feel more than ever the extent to which they were interlocked with industry in their fortunes and in the range of their obligations. He welcomed particularly Sir William Bragg, now President of the Royal Society, and Sir James Jeans.

Soon after taking over his present responsibilities at Euston, a committee was set up to advise what steps might best be taken to forward scientific research in all its numerous applications to railway practice. When he was President of the Institute of Transport in 1929, he had devoted his presidential address to the subject of scientific research in transport, and he was glad to say that some of his dreams had since become true. As the result of the advice of the committee in 1930, they set up a permanent advisory committee, and the technical departments and officers had, from the outset, valued the tremendous advantages of the co-operation of that committee.

The second outcome of the original committee was the development of the research department, designed to put on a more systematic basis much of the excellent work that had been done in a detached fashion up to that point, and to arrange for a more definite planning and vigorous prosecution of new lines of investigation. The functions of the Research Department were firstly to isolate and define their problems; secondly, to determine how they should be attacked, thirdly to act as scientific consultants to all departments, and fourthly to be a central information bureau with a specialised monthly review for the purposes of the department as a whole. Under Sir Harold Hartley's guidance, Mr. T. M. Herbert had gradually shaped it nearer to their heart's desire, paying due regard to the basic requirements of the research department and the peculiar characteristics and developments of their technical institutions.

The new laboratory, he continued, was an objective index of the state of progress reached, and they desired that it should be a sign to all their widespread departments that they had the highest skill to consult on all their problems in regard to engineering, metallurgical questions, paint and textiles. The day of haphazard and rule of thumb tests, under unmeasured conditions in inappropriate surroundings, was over, and the day of controlled and directed experiment under arranged conditions had fully arrived. At the same time, he would stress the fact that they were not trying to supersede or to rival scientific effort in all directions. They were still extending their use of outside facilities in connection with the Department of Scientific Research.

In declaring the new laboratory open, Lord Rutherford said he believed the L.M.S.R. was described as a public utility company, but it seemed to him to resemble rather a state within a state, with an annual gross revenue of nearly 70 millions, with its own land, sea and air forces all organised for the most efficient service to the community.

As a firm believer in the power of science, and in its application to industry, he was convinced there was hardly a single unit, whether of machinery or layout or even of organisation, that could not be improved for its purpose by the application of patient scientific research. To obtain the best results from such a laboratory it was essential that the staff should be encouraged to take a live interest in the work of the research department.

Apart from the early days of railways, there had never been a period of such intense activity as the present in the introduction of new ideas and methods to improve the economy and efficiency of railway services. The period of depression had coincided with the introduction of streamlined engines and trains, and in a general increase of speed. It had seen the process of air-conditioning on many American railways, though he supposed they would have to wait some time before such comparative luxuries were available on our English railways. In attacking research problems a company like the L.M.S.R. had a great advantage in the large scale of its operations in that even a small improvement might be applicable over at least 7,000 miles of track or be applied to each of their 8,000 locomotives, with substantial economic results.

The presentation of an ink-stand to Lord Rutherford by Sir Josiah Stamp concluded the opening ceremony.

On leaving the train the visitors were split into six parties for separate tours of the laboratory, locomotive, and carriage works. All kinds of British and foreign scientific instruments are installed in the laboratory for testing the qualities of the chief materials used by the railway, particularly metal, woods, paints, varnishes and textiles.

Perhaps the most novel demonstration was a cinema film showing the actual contact between wheel and rail on a train in motion, revealing the exact amount of lateral vibration which the tread and flange of the wheel undergo. It was explained that this film was photographed from a carriage compartment by means of a periscope let down through the floor. In the locomotive shops a wind tunnel was seen in operation for measuring the effect of streamlining.

The return journey to London was made in good time, the train leaving Derby at 3.50 p.m. and arriving at St. Pancras shortly after 6.30 p.m.

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PARLIAMENTARY NOTES

Railways (Agreement) Money Resolution

In Committee of the House of Commons on Tuesday, December 10, the Chancellor of the Exchequer moved the money resolution necessary for the Railways (Agreement) Bill, which resolution appeared in THE RAILWAY GAZETTE of December 6. Mr. Chamberlain recalled that in June last he had occasion to move a resolution very similar to that now submitted. That resolution was in connection with the scheme for the extension of work by the London Passenger Transport Board. The present resolution was in connection with another project, which concerned not London alone, but the whole country as covered by the four main line railways. This project was just another example of the policy of the Government to make use of the high level at which British credit now stood in order to further useful schemes of public works, which offered a prospect of providing considerable employment and of adding to the valuable assets of the country. The resolution on the last occasion was received with acclamation by the opposition.

In this case (proceeded Mr. Chamberlain), the works which were being provided by the four main line railways were of a very extensive character. They were described fully in the schedule of Command Paper 5027. There were among them new lines, extension of existing lines, electrification of existing lines, reconstruction of a number of stations, including Euston, which was the most important and largest single item on the list; the construction of over 400 new steam locomotives, and the construction also of other vehicles, and the provision of safety, signalling and other equipment. Altogether it might be said that this project, if carried through, would provide work in a great number of districts, including the special areas—other things being equal—and it would, moreover, add to the comfort, convenience, and safety of passengers.

He would emphasise that this programme was entirely additional to the ordinary programmes of railways which from time to time were carried out, and it was a programme which could not be carried through at all if it had not been possible for the Government to offer to the railways favourable financial terms for the raising of the necessary funds. This resolution was required to authorise the Bill, the second reading of which would be moved on Friday (December 13). It would be a short Bill, containing only two operative clauses, and it was particularly necessary that the Bill should be passed before Christmas in order that they might be quite certain of making sure of the present financial situation, and that the work might be put in hand as soon as possible.

Describing the method of procedure which it was proposed to adopt in order to carry out the financing of this proposal, Mr. Chamberlain said the method was the formation by the Treasury of a finance company. This finance company, when formed, would then issue securities, which would be guaranteed both as to principal and interest, by the Treasury, for the purpose of raising a sum of £26½ millions, and from that finance company in turn the railway companies would borrow as and when they required the money to undertake the works specified in the schedules, provided, of course, that the railway companies obtained from Parliament the powers which it would be necessary for them to get before they could put these works in hand. The loan which would be raised by the finance company would be of comparatively short duration. The House would appreciate that the shorter the period the lower the rate of interest which would have to be charged. It would be from 15 to 25 years. The exact period was left to be settled by the Treasury in the light of market conditions prevailing. The loan, when it matured, would have to be repaid, and the railway companies, as they had no sinking fund, with one small exception, would have to borrow again for the sums they borrowed from the company, when those sums became due. That was a procedure that might give rise to two questions from members. It might be asked why was it necessary to have a device of this kind. Why have a statutory company? The reason was this. The railway companies had got to get statutory powers before they could carry out those works at all. That would take some time. By forming a finance company the money could be raised at once, and they did not have to wait until the statutory powers had been obtained by the railway companies. At the present time the prevailing rates of interest were exceptionally low. He had no reason to suppose that in the course of the next few months these would rise, but he could not say they would not rise, and as the whole project really depended upon the power of the railway companies to obtain this money very cheaply, it was just making certain of raising the money now while the conditions were favourable. The finance company would raise the whole of the money at once. The whole of the money would not be required at once, and what was not required would be invested by the finance company until it was wanted. Of course, it would be possible for the railway companies to do the same thing, but he thought it would be agreed that it was reasonable to suppose that the finance company, dealing with the whole sum, would be able to invest the money more conveniently than the four companies separately. The second question that might be asked was why was it that the total amount which the finance company would raise was £26½ millions when the authorised total cost of the project will be 29½ millions. The answer to that was that the other £3,000,000 was to be provided by some of the railways themselves. There was a special reason for that, but he did not want to go into it now. The Agreement was scheduled in the Command Paper. There were a number of clauses, and if there had been more time he would have explained them in detail. Most of the clauses were self-explanatory, and if any member desired information either the Financial Secretary or himself would answer questions. He commended the Resolution to the Committee.

Mr. Herbert Morrison (South Hackney—Lab.) said that in important financial matters of this kind which affected the relationships between the State and great private statutory undertakings, it was unfortunate that such arrangements between the State and private capital should be announced in the middle of an election campaign. It might lead people to suspect that the railway companies and the Government had come to an agreement for political purposes.

Sir Robert Horne (Hillhead—U.) assured Mr. Morrison that the negotiations were entered into long before there was any thought of an election.

Mr. Morrison said that if the negotiations had not finished well before the election, and he had been in the position of Sir Robert Horne as chairman of a railway company, he would have said within ten days of the election "There is going to be no further agreement until this election is over." The proposal indicated that private capital could no longer stand upon its own feet in particular undertakings. The distance from that point to the recognition of the full Socialist case was not very far, and to that extent the Labour party was not indisposed to welcome this resolution. He would like to know whether all the works which it was proposed to put in hand were strictly abnormal works which in no case would the railway companies have put in hand without the State guarantee. It seemed to him that a number of them were works which he would have expected the companies to put in hand anyway, and he was not disposed to agree that the companies would not have done this work if the State had not given a guarantee. If the process continued far of private undertakings going to politicians and telling them that they could provide a certain amount of work and employment and incidentally a good electoral story, if the State provided a guarantee, it would not be long before private undertakings degenerated from their former status into a poor law public assistance frame of mind. When they got to the point where private enterprise could no longer be relied upon to stand on its own feet they were in danger of demoralising it and destroying its

self reliance and initiative. When that point was reached it was better to socialise transport.

The guarantee which the Government had given to the London Passenger Transport Board was in a different category, as that board was a public authority, but these were private capitalist undertakings. The Labour Party had an apprehension that this addition to railway capital, with a State guarantee, without any conditions, without any element of public control, was dangerous to the public interest. It was undoubtedly the case that British railways were over-capitalised at the present time. They were carrying a very high proportion of capital which was no longer productive. If these great undertakings wanted a State guarantee there must be a reasonable proportion of representatives of the State on boards of directors. The opposition appreciated that there would be some advantages to the public in the improvement of travelling facilities and they did not propose to vote against the resolution, but they would take this course subject to the very serious reservations which he had indicated.

Mr. D. O. Evans (Cardigan-Lib.) said the Liberal Party were very anxious that the work should be put in hand at the earliest possible moment. He noticed that the Great Western Railway Company was to spend under the resolution only about £5 or £6 millions over a period of five or six years. That seemed a very small sum of money. There was no provision in the agreement that work should be given to firms within special areas. What means were there of discovering whether work was given to special areas and on what terms? Was the machinery of the Ministry of Transport sufficient to supervise the work? He saw that according to the schedule the Great Western Railway Company were to rebuild a station at Llanelly, and also provide some additional lines to Porthcawl. There was not any great work for South Wales, which was responsible for a great deal of the revenue of the G.W.R. There was nothing in the schedule about electrification except in regard to the London Midland & Scottish and London & North Eastern lines. Surely there must be ample opportunity for a suitable scheme of electrification in South Wales.

Mr. G. Buchanan (Gorbals—I.L.P.) was complaining that he saw for Scotland only some additional carriage and storage sidings at Edinburgh, Craigendoran, and Cowlairs, and some additional facilities at Bathgate Junction. when the debate stood adjourned at eleven o'clock.

Resuming his speech on reconsideration of the money resolution for the Railways (Agreement) Bill on December 11:

Mr. Buchanan (Gorbals—I.L.P) said that the L.M.S.R. share of this money would be about £1,000,000, and he could not see why a company with such a large shareholding capital could not raise such a small sum in the open market. He contended that the railway companies ought to prove the need for this money and that there were other sections of the public more deserving of this form of indirect subsidy from the Government. There was no case for the railways receiving this money.

Mr. David Adams (Consett—Lab.) said he was disappointed at the smallness of the amount because, as a doctrinaire Socialist, he believed in maintaining and improving premier industries, which, according to Sidney Webb should, in time, be controlled by the State. This grant would make no differences to the financial resources of the State. The community were getting an advantage on exceedingly cheap terms. The Government ought not to make an advance of public money unless there was a measure of public representation. He contended that the Government should have representation in those industries to which they gave subsidies or guarantees.

Mr. Rhys Davies (Westhoughton—Lab.) contended that there were other areas in the country where the ratio of unemployment was greater than it was in the special areas, and therefore they should receive greater allocation in the work of manufacture under this guarantee.

Sir Ernest Shepperson (Leominster—C.) supported the resolution, and suggested that the railway companies should be more efficient in their services to the public. The L. & N.E. Railway Company had shown by the Silver Jubilee that they could do a speed of 100 miles an hour for trains. Yet why did they make him sit for 2¼ hours in the train from Huntingdon to London &c. He hoped that the railway companies would become more efficient in their service. They could do it.

Mr. Gallagher (West Fife—Communist) contended that no concern was shown for the workers in the giving of this guarantee. Improvement of the conditions of workers, shorter hours and better wages should be made a condition of the loan.

Major C. F. Entwistle (Bolton—C.) asked if the agreement providing that preference should be given to special areas would preclude contracts being given, where it was thought desirable, to districts which did not come under the definition of a special area.

Mr. G. Hardie (Springburn—Lab.) inquired where the money raised would be invested until it was required by the railway companies.

Mr. W. S. Morrison (Financial Secretary to the Treasury), replying to the discussion, said that all the works proposed were abnormal works at the present time. The railway companies would not have undertaken them at the present time were it not for this loan. The ordinary work of the railway companies in replacement and renewals would go on side by side with the new works under this proposal. None of the works specified in the schedule to the agreement would have been undertaken by the railway companies at the present time without the financial help set out in the agreement. It was suggested by Mr. Herbert Morrison that the Government were rushing to the rescue of the tottering railway companies. The exact opposite was the case. All the argument about failure of private enterprise would be germane and true if the financial arrangement was come to to enable the railways to continue running, but that was not so. The railway companies were running efficiently and well at the present time. Every day they transported millions of passengers and thousands of tons of goods. This resolution would enable the companies to carry out something extra from their ordinary duties, and that was setting in hand works before their normal time. It was not a case of the railway companies coming to the Government and asking for assistance, but of the Government going to the railway companies and asking them if they could not do something to put public works in hand now that the state of the money market was favourable. He had been asked the number of man-years of employment the scheme would give, and was informed that the expenditure of £1,000,000 would give 4,000 man-years of employment, so that the number of man years of employment given by the proposals would be 120,000, which was no small contribution. The agreement would not preclude areas outside the special areas receiving orders for work.

Mr. Ellis Smith (Stoke-on-Trent—Lab.) said that the efficiency of the railway companies had been increased at the expense of men employed in the industry. The number of men employed by the railway companies had fallen from 618,000 in 1913, to 597,000 in 1935.

Upon a division, the Resolution was carried by 164 votes to 2.

Questions in Parliament

Railway Passenger Duty

Mr. Thorne on December 11 asked the Minister of Transport whether the remission of railway passenger duty under the Cheap Trains Act, 1883, was still in operation; and, if so, whether he could state the amount of remission duty paid by the various railway companies for the past three years to the nearest available date.

Mr. Hore-Belisha.—Railway passenger duty ceased to be chargeable by virtue of the Finance Act, 1929. The railway companies then undertook to expend upon a special programme of works sums based upon the capitalised value of the duties remitted.

THE PRINCE OF WALES AS PATRON OF ACETYLENE CONGRESS.—The Prince of Wales has consented to be patron of the twelfth International Congress of Acetylene, Oxy-acetylene welding and allied industries, which will be held in London in 1936.

XUM

NOTES AND NEWS

Another G.W.R. Halt.—A new halt at Westwood, between Much Wenlock and Presthope, was opened by the G.W.R. on Saturday, December 7.

Collision in Italy.—A fast train to Rome, which had come to a stand at Frattamaggiore station, near Naples, owing to engine trouble, was run into in the rear by a following train on December 8. Four people are reported to have been killed, and 50 injured.

Bournemouth Belle to Run Every Day.—Beginning on January 1, the Bournemouth Belle Pullman train, Southern Railway, which now runs on Sundays only, is to run on weekdays also, leaving Waterloo at 10.30 a.m. and arriving there after the return journey at 6.55 p.m. The train serves Southampton Central and Bournemouth Central and West, and takes 2 hr. 20 min. in each direction.

Railway Benevolent Institution Casualty Fund.—A collection for this fund is now being made by station-masters, goods agents, and others throughout the country. A subscription of 1s. brings a return of about 3s. 6d. a week while disabled by accident (£5 maximum), £5 to the widow of the member killed, and £3 to the widow of the member dying from natural causes. Benefits are paid irrespective of other income.

Conversion of Wooden to Steel Coaches, P.L.M. Railway.—Ninety P.L.M. third class coaches which were placed in main line service in 1922 are being rebuilt with steel bodies. These vehicles are of the ten-compartment type, with corridor connections, and originally had wooden bodies on steel underframes. The new tubular steel framework, erected on the existing chassis, is built up of two longitudinal sheet steel side members (62 ft. 4 in. × 3 ft. 11 in. × ¼ in.) to which are riveted the side sills and uprights—the latter joined top and bottom by steel sections. The roof is also of riveted sheet steel. The compartments are provided with upholstery and improved lighting and heating. Linoleum is laid on the floor, and the bodies are insulated against noise and external heat.

French Speed Record.—On December 4 one of the 500 b.h.p. two-car Renault diesel trains of the Etat (described in the *Diesel Railway Traction Supplement* for October 5, 1934) was given a trial run on the lines of the Est, and made a return journey between Paris and Mulhouse, running on the outward journey via Nancy and Strasbourg, in 8 hr. 2 min., the average for the whole distance of 689 miles being 85·6 m.p.h., although the maximum speed was limited to 93 m.p.h. The 219 miles from Paris to Nancy occupied 150 min. (87·6 m.p.h.); the 93·2 miles from Nancy to Strasbourg, 64½ min. (87 m.p.h.); and the 67·7 miles from Strasbourg to Mulhouse, 48 min. (84·7 m.p.h.). The return trip of 305 miles was made in 219½ min. at an average of 83·8 m.p.h.

Turkish State Railways in Europe ?—Press reports from Istanbul state that the Turkish Government is negotiating for the purchase of the railway from Istanbul to the Greek and Bulgarian frontiers. This railway is at present in the hands of the Oriental Railways Company, which, prior to the European war, was Austrian owned, but is now controlled by a French syndicate.

New L.N.E.R. Evening Service to Yorkshire.—On January 1 the L.N.E.R. will inaugurate an experimental late evening restaurant car service from King's Cross to Yorkshire. The train, which will run every weekday, will leave King's Cross at 7.15 p.m., arriving at Doncaster at 10.3 p.m., Wakefield at 10.35 p.m., Leeds at 10.54 p.m., Bradford at 11.29 p.m., and Hull at 11.0 p.m. Conditional stops will be made at Brough, Ferriby, and Heffle. Continuance of the service will depend upon the patronage it receives.

L.M.S.R. Operating Department Dinner at Crewe.—The twelfth annual dinner of the Office of the Divisional Superintendent of Operation, Western Division, was held in the Crewe Arms Hotel, Crewe, on December 6. The toast of the "L.M.S." was proposed by Mr. J. C. Foster, Assistant, Motive Power Section, and responded to by Mr. S. H. Fisher, Assistant Chief Operating Manager, in the unavoidable absence of Mr. C. R. Byrom. Mr. A. P. Hunter, Divisional Controller, Passenger Services, extended a hearty welcome to the visitors, and this was responded to by Mr. C. Phizackerley, Freight Assistant to the Chief Operating Manager. The toast of "The Chairman," Mr. S. E. Parkhouse, was proposed by Mr. C. H. Latham, and in his reply Mr. Parkhouse thanked his staff for their assistance in all departments. A smoking concert followed.

The Key West Railway, Florida.—The Social and Economic Union of Cuba recently cabled from Havana a petition to President Roosevelt asking his aid in the re-establishment of railway communications between Key West and the Florida mainland as a gesture of sympathy and co-operation toward the town that played a prominent part in the Cuban struggle for independence at the time of the Spanish-American War. The Key West extension of the Florida East Coast Railway, which runs some 64 miles on viaduct across open water and a group of small islands, was destroyed by the hurricane of September 2 and, as we recorded on page 608 of our issue of October 11, rebuilding has since been deferred. Meanwhile there have been reports from Washington that the Reconstruction Finance Corporation has been approached with a proposal that it should finance building a road to Key West which would use the railway roadbed.

Road Accidents.—The Ministry of Transport return for the week ended December 7 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year:—

	Killed, including deaths resulting from previous accidents		Injured	
England ...	112	(136)	3,705	(3,569)
Wales	1	(5)	146	(146)
Scotland ...	11	(15)	359	(307)
	124	(156)	4,210	(4,022)

The total fatalities for the previous week were 146, as compared with 140 for the corresponding period of last year.

Mr. R. E. Charlewood.—We are glad to be able to record the release of Mr. R. E. Charlewood, whose arrest and detention in Germany we have already noted in these columns on more than one occasion. He was released without being sent for trial, and it is significant that this act of clemency coincided with the celebration of the German Railway Centenary—mentioned elsewhere in this issue—during last week-end. Mr. Charlewood and his solicitor were given privileges, while the former was in prison, not usually allowed in Germany in such circumstances. The reason for the leniency of the authorities appears to be that they were satisfied that he had no intention of using the information he had gleaned to the detriment of Germany, as he was merely following his custom of taking notes about British and other railways.

Vassar-Smith Ambulance Shield Competition.—Six teams of G.W.R. ambulance men contested with great keenness possession of the Vassar-Smith challenge shield at the seventeenth annual competition for this trophy, which took place at the Princes Hall on November 23. Mr. L. J. A. Callaway, District Goods Manager, occupied the chair, and others present included the Mayor and Mayoress (Mr. and Mrs. William H. Nicholls), the City High Sheriff (Mr. H. Collier) and Mrs. Collier, and Mr. W. Stevens, Assistant Divisional Superintendent. The adjudicators were Dr. F. H. Sprague for the team test, which represented an aeroplane accident, and Mr. F. J. H. Stallman for the individual tests. A special test on roller bandaging was judged by Sister Denly. The Chairman, announcing the results, said that Mr. S. Morris, their former Divisional Superintendent and President of the Corps, would have been with them today but that he was called to St. John's Gate for his investiture as a Member of the

Order of St. John. He declared the result as under :—

	Marks
1st. Team E. (Capt., W. Flew) ...	80
2nd. Team F. (Capt., E. J. Colley) ...	77
3rd. Team A. (Capt., C. T. Drinkwater)	76

In the individual section : 1st, R. P. Sims, 78 points ; 2nd, F. A. Drinkwater, 77 ; 3rd, E. T. Williams, 70. Roller bandaging test : 1st, C. T. Drinkwater, 90 per cent. ; 2nd, E. J. Colley, 86 ; 3rd, W. Flew, 85.

The shield was presented by the Mayor, who said there were few things so well worth doing as helping suffering in times of emergency. Prizes to team members were presented by the Mayoress, and those for bandaging and individual work by Mrs. Collier.

Great Southern Railways' Inaugural Staff Dance.—The inaugural staff dance of the Great Southern Railways was held in the Gresham Hotel, Dublin, on Monday, December 2, under the patronage of Sir Walter Nugent, Bt., Chairman, and the board of directors ; Mr. W. H. Morton, M.I.Mech.E., General Manager, was President and the chief officers of the company acted as Vice-Presidents. The proceeds of the dance are to be given to the Railway Benevolent Institution. Hitherto separate dances were held by the staffs of the different sections of the service, now combined. The dance proved most enjoyable and a great success, and was attended by about 1,000 people. Among those present were :—

Sir Walter and Lady Nugent, the Rt. Hon. James MacMahon, P.C. (Director), Mrs. MacMahon and Miss MacMahon, Dr. Lombard Murphy (Director), Mr. W. H. Morton (General Manager) and Miss Morton, Mr. P. J. Floyd (Traffic Manager) and Mrs. Floyd, Mr. A. W. Bretland (Chief Engineer) and Mrs. Bretland, Mr. J. J. McDonald (Law Agent) and Mrs. McDonald, Mr. H. Stewart Coe (Secretary) and Mrs. Coe, Mr. J. H. Nicholson (Signals and Telegraphic Engineer) and Mrs. Nicholson, Mr. J. P. Meadows (Stores Superintendent) and Mrs. Meadows, Mr. Hartnell Smith (Accountant), Mr. R. Stewart (Manager, Road Freight Department) and Miss Stewart, Mr. A. V. Fraser (Chief Cashier) and Miss Fraser, Mr. J. H. White and Miss White, Mr. and Mrs. J. M. Irwin, Irish Traffic Manager (L.M.S.R.), Senator and Mrs. O'Farrell, Mr. Davis, T.D., Mr. and Mrs. D. Stewart, Mr. Anderson (Chairman of Dance Committee), Messrs. Hayes and Coughlan (Honorary Secretaries), Mr. F. Doherty (Honorary Treasurer)

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 49th Week			Totals to Date		
	1935	1934	Inc. or Dec.	1935	1934	Inc. or Dec.
L.M.S.R. (6,923 mls.)	£	£	£	£	£	£
Passenger-train traffic...	390,000	393,000	— 3,000	23,586,000	23,213,000	+ 373,000
Merchandise, &c. ...	488,000	467,000	+ 21,000	22,182,000	21,962,000	+ 220,000
Coal and coke ...	301,000	287,000	+ 14,000	11,394,000	11,238,000	+ 156,000
Goods-train traffic ...	789,000	754,000	+ 35,000	33,576,000	33,200,000	+ 376,000
Total receipts	1,179,000	1,147,000	+ 32,000	57,162,000	56,413,000	+ 749,000
L.N.E.R. (6,336 mls.)						
Passenger-train traffic...	271,000	275,000	— 4,000	15,449,000	15,133,000	+ 316,000
Merchandise, &c. ...	333,000	335,000	— 2,000	15,481,000	15,533,000	— 52,000
Coal and coke ...	252,000	252,000	—	11,060,000	11,175,000	— 115,000
Goods-train traffic ...	585,000	587,000	— 2,000	26,541,000	26,708,000	— 167,000
Total receipts	856,000	862,000	— 6,000	41,990,000	41,841,000	+ 149,000
G.W.R. (3,749¼ mls.)						
Passenger-train traffic...	170,000	174,000	— 4,000	9,993,000	9,877,000	+ 116,000
Merchandise, &c. ...	193,000	184,000	+ 9,000	8,939,000	8,838,000	+ 101,000
Coal and coke ...	118,000	108,000	+ 10,000	4,900,000	4,896,000	+ 4,000
Goods-train traffic ...	311,000	292,000	+ 19,000	13,839,000	13,734,000	+ 105,000
Total receipts	481,000	466,000	+ 15,000	23,832,000	23,611,000	+ 221,000
S.R. (2,153 mls.)						
Passenger-train traffic...	239,000	234,000	+ 5,000	14,631,000	14,227,000	+ 404,000
Merchandise, &c. ...	51,500	55,000	— 3,500	3,001,500	3,178,000	— 176,500
Coal and coke ...	28,500	29,000	— 500	1,468,500	1,507,000	— 38,500
Goods-train traffic ...	80,000	84,000	— 4,000	4,470,000	4,685,000	— 215,000
Total receipts	319,000	318,000	+ 1,000	19,101,000	18,912,000	+ 189,000
Liverpool Overhead ... (6¼ mls.)	1,138	1,095	+ 43	57,669	55,671	+ 1,998
Mersey (4½ mls.) ...	4,335	4,224	+ 111	197,475	199,865	— 2,390
*London Passenger Transport Board ...	544,800	539,300	+ 5,500	12,511,300	12,300,900	+ 210,400
IRELAND						
Belfast & C.D. pass. (80 mls.)	1,564	1,545	+ 19	123,223	121,900	+ 1,323
,, ,, goods	598	577	+ 21	25,208	25,473	— 265
,, ,, total	2,162	2,122	+ 40	148,431	147,373	+ 1,058
Great Northern pass. (543 mls.)	8,750	7,800	+ 950	512,800	488,550	+ 24,250
,, ,, goods	7,400	6,150	+ 1,250	463,150	431,600	+ 31,550
,, ,, total	16,150	13,950	+ 2,200	975,950	920,150	+ 55,800
Great Southern pass. (2,124 mls.)	21,289	21,138	+ 151	1,197,169	1,170,049	+ 27,120
,, ,, goods	48,343	43,948	+ 4,395	1,771,188	1,653,089	+ 118,099
,, ,, total	69,632	65,086	+ 4,546	2,968,357	2,823,138	+ 145,219

* 23rd week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year ; last year's figures are, however, adjusted for comparative purposes

British and Irish Railways Stocks and Shares

Stocks	Highest 1934	Lowest 1934	Prices Dec. 11, 1935	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	66½	48½	51	—
5% Con. Prefce. ...	118	109	119½	+1
5% Red. Pref. (1950)	115	107	110½	—
4% Deb.	117	105	114	—
4½% Deb. ...	119	109	115½	—
4½% Deb. ...	129½	115¼	124½	—
5% Deb.	135	126¼	136½	—
2½% Deb.... ...	75	64	73	+1
5% Rt. Charge ...	134⁷⁄₁₆	123¼	135½	+1
5% Cons. Guar. ...	132⅝	121⅜	133½	+1
L.M.S.R.				
Ord.	30½	19½	18	—
4% Prefce. (1923)	64¼	41	53½	−1
4% Prefce. ...	87	69½	84	—
5% Red. Pref. (1955)	107	92½	103½*	—
4% Deb.	114⅛	100½	109*	—
5% Red. Deb. (1952)	118¹¹⁄₁₆	111¼	115½	+3
4% Guar.... ...	106½	96⅝	105	—
L.N.E.R.				
5% Pref. Ord. ...	24⅝	13½	10	—
Def. Ord.	11½	6⅞	5¾	+⅛
4% First Prefce....	76	59½	59½	—
4% Second Prefce.	47	25½	21	−½
5% Red. Pref. (1955)	94½	80	80½	+1
4% First Guar. ...	104	92	101	+½
4% Second Guar.	97⅞	86½	93	+1
3% Deb.	90	74½	84*	—
4% Deb.	114	99¼	108*	—
5% Red. Deb. (1947)	117	108	114½	+3
4½% Sinking Fund Red. Deb.	111¼	105¼	109*	—
SOUTHERN				
Pref. Ord.... ...	90	63⅛	84	−3
Def. Ord. ...	32⅝	19	21½	−1
5% Prefce. ...	118³¹⁄₁₆	107½	119½	+1½
5% Red. Pref. (1964)	115¾	107½	113½	—
5% Guar. Prefce.	132	120¾	134½	+2
5% Red. Guar. Pref. (1957)	119½	113	116½	+1
4% Deb.... ...	116½	103¼	113*	—
5% Deb.	134	124¹³⁄₁₆	133½*	—
4% Red. Deb. 1962–67	113¹¹⁄₁₆	105⁹⁄₁₆	111½*	—
BELFAST & C.D.				
Ord.	6	5	9	—
FORTH BRIDGE				
4% Deb.	110	100	105½	—
4% Guar. ...	110	100	104½	—
G. NORTHERN (IRELAND)				
Ord.	9¾	4¹⁵⁄₁₆	15¼	—
G. SOUTHERN (IRELAND)				
Ord.	25	12½	40½	+½
Prefce.	21½	13¹⁵⁄₁₆	50	+2
Guar.	48	39	88½	+⅜
Deb.	67	59	85¾	+⅜
L.P.T.B.				
4½% "A" ...	126	115	122½*	+1
5% "A" ...	135½	124½	132½*	—
4½% "T.F.A." ...	113½	107½	109½*	+½
5% "B" ...	131¾	118	128½*	—
"C"	97	73	109	—
MERSEY				
Ord.	15¼	7	21	—
4% Perp. Deb. ...	93½	82½	97½	—
3% Perp. Deb. ...	66½	61½	76	—
3% Perp. Prefce.	54	44½	60½	+1

* ex dividend

CONTRACTS AND TENDERS

Large Belgian Rolling Stock Orders

Orders for 500 all-steel coaches for suburban traffic have recently been placed by the Belgian National Railways Company, as follow :—

250 *Third Class Coaches :*

Ateliers Métallurgiques de Nivelles	40
Compagnie Centrale de Construction, Haine-St-Pierre	40
Société Anglo-Franco-Belge de Matériel de Chemins de fer, La Croyère	40
Société Baume & Marpent, Haine-St-Pierre	25
Ateliers de Construction de Familleureux	45
Ateliers de Construction d'Enghien-St. Eloi, Enghien	30
Ateliers Germain, Monceau-sur-Sambre	30

125 *Second and Third Class Composites :*

Ateliers de la Dyle, Louvain	45
La Brugeoise, Nicaise & Delcuve, Bruges	45
Usines Ragheno, Malines	35

125 *Composite Third Class and Luggage*

La Brugeoise, Nicaise & Delcuve, La Louvière	30
Société Energie, Marcinelle	30
Usines de Braine-le-Comte	20
Ateliers de Seneffe, Seneffe	25
Ateliers de Godarville, Godarville	20

A description of these vehicles is given on p. 1007.

The Gloucester Railway Carriage & Wagon Co. Ltd. has received an order for 10 refrigerator van bodies from the Rhodesia Railways.

Guest, Keen & Nettlefolds Limited has received an order from the Buenos Ayres Great Southern Railway for 31,000 rails clips for 100-lb. rails.

The Anderston Foundry Co. Ltd. has received an order from the Chinese Government Purchasing Commission, to the inspection of Messrs. Sandberg, for 200 metric tons of dogspikes, for the Canton-Hankow Railway.

Alfred Herbert (India) Limited has received orders from the Indian Stores Department for the following machine tools :—Two sliding, surfacing and screw-cutting lathes, one milling machine, two grinding machines, one saw sharpening machine and three drilling and tapping machines.

The Bombay, Baroda & Central India Railway Administration has placed the following orders, to the inspection of Messrs. Rendel, Palmer & Tritton :—S. A. Gilsoco, 42,273 fishplates for electric bonding ; Dorman Long & Co. Ltd., 7,712 pairs and 248 single fishplates for electric bonding.

D. Wickham & Co. Ltd. has received an order from the Argentine State Railway for two metre-gauge No. 8A light inspection, petrol driven railcars.

Underframes for China

The Metropolitan-Cammell Carriage & Wagon Co. Ltd. has received an order from the Chinese Government Purchasing Commission, to the inspection of Messrs. Sandberg, for 33 standard gauge bogie carriage underframes complete with Westinghouse brake gear, for the Nanking-Shanghai Railway.

Leyland Motors Limited has received orders from Cumberland Motor Services Limited for six oil-engined Titan and three Tiger passenger vehicles.

Bayliss, Jones & Bayliss Limited has received an order from the Buenos Ayres Great Southern Railway for 31,000 clip bolts and lock nuts for cast steel chairs.

Reconstruction of bridges at Miles Platting (Manchester) and on the Bolton-Blackburn line is included in the latest contracts placed by the L.M.S.R. These contracts include : with a Darlaston firm for the reconstruction of overbridge No. 10 (Tonge Head Bridge) at The Oaks, Bolton-Blackburn line ; with a Derby firm for the reconstruction and widening of two bridges over Queen's Road at Miles Platting ; and with a Cambridge firm for the extension of warehouse for Cadbury Brothers.

H. W. Kearns Limited has received an order for one portable boring machine for the South Indian Railway, through Messrs. Robt. White & Partners.

L.M.S.R. Orders for Two Ships

The L.M.S.R. announces the placing of orders with two Scottish firms for two of the three new vessels provided for in the company's 1936 works programme. Wm. Denny & Bros. Ltd., Dumbarton, is to supply a new cargo and live-stock steamer for the Heysham-Belfast service, and Wm. Simons & Co., Renfrew, has received the order for a dredger for use at Fleetwood Harbour. The new cargo and live-stock steamer for the Heysham-Belfast service will be capable of carrying about 730 head of cattle, and will have an overall length of 309 ft., moulded breadth 45 ft., and moulded depth, 16 ft. 6 in. The machinery will consist of two sets of Parsons single-reduction geared turbines, and steam will be generated by two coal-fired Babcock & Wilcox boilers. The bucket dredger for use at Fleetwood Harbour will be of the non-propelled single ladder type, the principal dimensions being : length overall, 176 ft., and moulded breadth, 33 ft. 6 in. The normal dredging capacity will be 1,000 cu. yd. per hour at a depth of 37 ft., and the dredging machinery will be driven by one set of direct acting inverted triple-expansion surface-condensing engines, with belt drive.

F. Morton & Co. Ltd. has received an order for a steel loading platform shelter, 300 ft. long, for the Nyasaland Railways.

British (Guest, Keen, Baldwins) Iron & Steel Co. Ltd. has received an order from the Buenos Ayres Midland Railway for 52 tons of 55-lb. steel rails and 300 pairs of fishplates.

The Bengal-Nagpur Railway Administration has placed orders with Robt. Stephenson & Co. Ltd for sets of locomotive coupled wheels and axles, and with Petters Limited for spare parts for compressor plant engines.

The Variable Speed Gear Co. Ltd. has received an order for two sets of VSG-Lysholm hydraulic torque converters for installation with 102 b.h.p. Gardner diesel engines in railcars being converted from the petrol type by the Queensland Government Railways. The conversion of 30 further cars on similar lines is contemplated.

H. J. Skelton & Co. Ltd. has received an order from the Burma Railways, to the inspection of Messrs. Rendel, Palmer & Tritton, for 270 locomotive tyres.

Sheffield-Twinberrow Welded Bogies for India

G. H. Sheffield & Co. (Engineers) Ltd., Calcutta, has received an order from the Indian Stores Department for 10 Sheffield-Twinberrow double-framed welded coach bogies required for East Indian Railway broad-gauge 68-ft. underframes and complete with wheels and axles and Skefko axleboxes, to the inspection of Messrs. Rendel, Palmer & Tritton.

The Kampsax Consortium is calling for tenders, to be presented in Teheran by January 13, 1936, for the supply of 100 small steel railway bridges consisting of primary sections. Further particulars of this call for tenders may be obtained by firms desirous of offering steelwork of United Kingdom manufacture upon application to the Department of Overseas Trade.

Forthcoming Events

Dec. 13 (*Fri.*).—Railway Club, at Broad Street Station Restaurant, E.C.1. Annual Dinner.

Dec. 14 (*Sat.*).—L.N.E.R. Musical Society, at Queen's Hall, Langham Place, London, W.1, 8 p.m. Carol Performance.

Stephenson Locomotive Society (Midland and Northern Counties), at 4, Bury Old Road, Cheetham Hill, Manchester, 6.30 p.m. "Smoke Lifting Devices on Locomotives," by Mr. Whitworth.

Dec. 16 (*Mon.*).—Institute of Transport (Scottish), at North British Station Hotel, Princes Street, Edinburgh, 7.15 p.m. Visit of the President.

Dec. 17 (*Tues.*).—Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 6 p.m. "Mechanisation of Railway Goods Depots." Part I, "Cartage," by Mr. E. Falconer ; Part 2, "Barrowing," by Mr. A. E. Hammet.

Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. "The Strengthening of the Dorabhavi Viaduct on the Madras & Southern Mahratta Railway, India," by Mr. H. W. Robinson.

Permanent Way Institution (Scottish), at Royal Technical College, George Street, Glasgow, 7.15 p.m. "Railway Signalling, Old and New," by Mr. W. Bryson.

Permanent Way Institution (York), at Railway Inst., Queen Street, 6.30 p.m. "The Work of a Renewal Ganger," by Mr. H. W. Clarke.

Dec. 18 (*Wed.*).—Diesel Engine Users' Association, at Caxton Hall, Caxton Street, London, S.W.1, 3 p.m. Annual General Meeting. "High Speed Diesel Engines," by Mr. O. Wans.

Institute of Transport (Manchester-Liverpool Graduate), at Grosvenor Hotel, Deansgate, Manchester, 6.45 p.m. "The Effect of Elasticity of Demand on Tramway and Bus Fares," by Mr. J. Gillanders.

Institution of Railway Signal Engineers, at Inst. of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. "Switching of Block Sections," by Mr. F. Burton.

Permanent Way Institution (Brighton), at Welfare Room, Eastbourne Station, 7 p.m. "Permanent Way," by Mr. Williams. "General Maintenance," by Mr. White.

Dec. 19 (*Thurs.*).—Manchester and District Traffic Association, at Grand Hotel, Aytoun Street, 7.15 p.m. "Continental Traffic," by Mr. E. Livesey.

XUM

PARLIAMENTARY NOTICES

IN PARLIAMENT.
SESSION 1935-36.

Southern Railway

NOTICE IS HEREBY GIVEN that application has been made to Parliament in the present Session by the Southern Railway Company for an Act under the above name or short title intituled "A Bill to empower the Southern Railway Company to construct Works and acquire Lands; to extend the time for the compulsory purchase of certain Lands; to empower the said Company and the London Midland and Scottish Railway Company to construct certain Works; to authorise financial arrangements with respect to certain works and facilities to be provided by the Southern Railway Company under an Agreement with the Treasury; to raise additional capital; and for other purposes."

A Notice containing a concise summary of the purposes of the intended Act has been or will be published in *The Times* newspaper of the 2nd and 9th December, 1935.

On and after the 4th day of December, 1935, a copy of the Bill may be inspected and copies thereof obtained at a price not exceeding seven shillings for each copy at the offices of the undermentioned Solicitor and Parliamentary Agents and at the Stationmaster's office at the following railway stations of the Company, viz., Winchester, Maidstone (West), Guildford and Templecombe.

AND NOTICE IS HEREBY ALSO GIVEN that on or before the 20th day of November, 1935, plans and sections relating to the said intended works and plans of all lands which may be taken or used compulsorily with a book of reference to such plans were deposited for public inspection as follows (that is to say):—

As regards works and lands in the County of Southampton with the Clerk of the County Council of that County at his office at Winchester as regards works and lands in the County of Kent with the Clerk of the County Council of that County at his office at Maidstone; as regards works and lands in the County of Surrey with the Clerk of the County Council of that County at his office at Kingston-upon-Thames; as regards works and lands in the County of Somerset with the Clerk of the County Council of that County at his office at Taunton; and as regards lands in the City and County Borough of Portsmouth with the Town Clerk of that City at his office at Portsmouth.

And that copies of so much of the said plans, sections and book of reference as relates to each of the several areas hereinafter mentioned in or through which the said intended works are proposed to be made or lands are situate were on or before the said 20th day of November deposited for public inspection as follows (that is to say):—

As relates to the borough of Dover with the Town Clerk of that borough at his office; as relates to any urban district (not being a borough) or to any rural district with the Clerk of the district council of such district at his office; and as relates to any parish comprised in a rural district with the Clerk of the parish council of such parish at his office or if he has no office at his residence.

Dated this 5th day of December, 1935.

WM. BISHOP,
Waterloo Station,
London, S.E.1.
Solicitor.

SHERWOOD & CO.,
22, Abingdon Street,
Westminster, S.W.1.
Parliamentary Agents.

RAILWAY AND OTHER REPORTS

Rohilkund & Kumaon Railway.—The board recommends a final dividend for the year ended September 30, 1935, of 6 per cent., together with a bonus of 4 per cent. on the company's ordinary stock, making the *ad-interim* dividend and bonus of 6 per cent. paid in July, 1935, a total payment of 16 per cent. per annum. The dividend and bonus will be paid less income tax at 2s. 5d. in the £, and will be payable on January 27, 1936.

Bengal & North Western Railway.—A final dividend is recommended for the year ended September 30, 1935, of 7 per cent., together with a bonus of 1 per cent. on the company's ordinary stock, making with the *ad-interim* dividend and bonus of 8 per cent. paid in July, 1935, a total of 16 per cent. per annum. The dividend and bonus will be paid less income tax at 2s. 6d. in the £, and will be payable on February 3, 1936.

Assam Bengal Railway.—Gross receipts, including those of the Mymensingh-Bhairab-Bazar, Chaparmukh-Silghat, and Katakhal-Lalabazar railways, for the year ended March 31 last, were Rs. 1,92,08,013, against Rs. 1,73,11,354, and the working expenses Rs.1,42,69,939 compared with Rs. 1,34,95,358 in the previous year, with the result that the ratio of working expenses to receipts has fallen from 77·96 to 74·29. Taking the company's own line separately, the gross earnings amounted to Rs. 1,81,70,795, and the net earnings to Rs. 49,38,074, or 2·11 per cent. on the capital expenditure. The total open mileage of the system is 1,306 miles, being the same as in the previous year. The balance in England on account of the company's surplus profits at March 31 last was £1,827. To this must be added a small sum of £4 13s. 2d. in respect of interest on deposit, less charges, since received. These sums the board proposes to carry forward.

Associated Equipment Co. Ltd.—The report of the year ended September 30, 1935, shows that after charging factory and administration expenses, directors' fees and depreciation, and providing for income tax and crediting interest, &c., there is a net profit on trading for the year of £129,198. After adding £233,984 brought forward there is a credit balance of £368,182. Deducting £31,250 for interim dividend of 5d. per unit of £1 stock, free of tax (approximately $2\frac{1}{16}$ per cent., subject to tax), there remains a balance of £331,932, from which £25,000 has been transferred to general reserve, and it is proposed to pay a final dividend of 10d. per unit of £1 stock, free of tax (approximately $5\frac{3}{8}$ per cent., subject to tax), which will absorb £62,500, leaving £244,432 to be carried forward.

Central Railway of Chubut.—The report states that it had been hoped that before the conclusion of the financial year ended June 30, 1935, the Argentine State Railways would have completed the contract to purchase the railway. The authorities have continued to lease the line, but no rent has been received for the 12 months to June 30, 1935, nor has any payment been made in respect of the outstanding amount of £10,820 due at June 30, 1934. An offer has, however, been accepted by the board, under which payment of the purchase price will be made in Argentine 4 per cent. sterling bonds 1933, and the board has reason to believe that at no very distant date a payment will be received on account of the capital sum due for the railway in these bonds. It is impossible at the moment to give any figures relating to the final settlement for the purchase of the railway, but it is proposed, as soon as possible after payment has been made, to submit a scheme to the shareholders for the liquidation of the company.

Interoceanic Railway of Mexico (Acapulco to Vera Cruz).—According to the adjusted working returns received from the National Railways of Mexico, the operating managers of the Interoceanic System (which includes the lines of the two lessor companies—the Mexican Eastern Railway Co. Ltd. and the Mexican Southern Railway Limited), the operations for the year 1934, on the basis of exchange at the rate of 10 Mexican pesos to the £, resulted in a loss of approximately £98,000, as compared with £118,000 in the previous year. During the year under review the number of passengers and the freight tonnage carried were substantially greater than during the previous year. The gross earnings, however, whilst being higher, suffered from reduced tariff rates consequent upon increasing competition by road transport. Operating conditions remained entirely unsatisfactory and expenses showed a still further increase. Growing labour demands and the rigid working regulations in force continued to add to the already unduly high cost of the personnel employed on the system. An advance in the price of fuel oil also contributed to the heavier expenses.

XUM

Railway Share Market

The stock and share markets have maintained a steady tendency during the week although an expansion in business has been checked by the international political situation. Home railway stocks kept the higher level of prices reached last week whilst Southern preferred and deferred have only lost a fraction of their advance. Current quotations are better than for some time. Buying of Southern stocks has not been based so much on traffic receipts (these proved disappointing on Wednesday) as on market expectations of a favourable decision in the appeal against the reduced rating assessment.

If this expectation proves reasonably accurate it is anticipated that the preferred stock will rise in due time to par or about 14 points above the current quotation. It is not suggested in the market that the stock will move immediately to this large extent but that incentive will be given to buyers by the possible increase next year to the full dividend rate of 5 per cent. on this stock. London Midland and Scottish 1923 preference stock is another home railway security which is estimated to combine both a reasonable return of income and possibility of large capital increase. A new high record was set up this week by the London Transport Board's "C" stock in which business was done at around 109. The Stock Exchange is awaiting with much interest the new railway finance company's stock which it is anticipated will become as popular as London Transport Board's stocks. Foreign railway stocks have tended to recede on some profit-taking. Many holders of Argentine railway stocks have been able to sell recently at about 50 per cent. higher than was paid for stocks early this year.

The Stock Exchange is taking a hopeful view about the prospect of concession by the Argentine Government in regard to remittances home and cost of exchange to the railways. Investors who switched out of Argentine railway stocks into American railroad common shares are exchanging back again owing to improved business reports from the Argentine. International Central America preferred has risen two points without bringing out stock, the last business having been on the 5th inst.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1934-35	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1934	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1934	Prices: Lowest 1934	Prices: Dec. 11, 1935	Prices: Yield % (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili)&Bolivia	830	8.12.35	16,990	– 440	49	615,510	730,480	– 114,970	Ord. Stk.	26 3/4	19	20	Nil
	Argentine North Eastern ..	753	7.12.35	8,008	+ 1,645	23	188,884	172,456	+ 16,428	,,	11	6 7/8	6	Nil
	Argentine Transandine ..	—	—	—	—	—	—	—	—	A. Deb.	52	45	48	85 16
	Bolivar	174	Nov., 1935	6,000	+ 250	48	66,600	65,700	+ 900	6 p.c. Deb.	10	6 1/2	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	13 3/4	10 7/16	13	3 15/16
	Buenos Ayres & Pacific ..	2,806	7.12.35	78,261	+ 7,735	23	1,698,514	1,580,566	+ 117,948	Ord. Stk.	16 1/2	8 1/2	8 1/2	Nil
	Buenos Ayres Central ..	190	16.11.35	$101,800	+ $4,600	20	$2,471,706	$2,528,000	– $56,300	Mt. Deb.	23	10	13	Nil
	Buenos Ayres Gt. Southern	5,085	7.12.35	119,213	+ 3,131	23	2,720,055	2,761,652	– 41,597	Ord. Stk.	35	22	19	Nil
	Buenos Ayres Western ..	1,930	7.12.35	45,535	+ 1,091	23	921,361	948,138	– 26,777	,,	27 1/2	18 1/2	15	Nil
	Central Argentine	3,700	7.12.35	100,911	– 1,536	23	2,679,104	2,663,674	+ 15,430	,,	23	13 1/2	12 1/2	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	14	7	6	Nil
	Cent. Uruguay of M. Video	273	30.11.35	14,165	+ 2,350	22	210,963	368,648	– 157,685	Ord. Stk.	15 1/2	3	5	Nil
	Do. Eastern Extn.	311	30.11.35	2,983	+ 267	22	34,374	36,665	– 2,291	—	—	—	—	—
	Do. Northern Extn.	185	30.11.35	1,418	+ 390	22	24,587	19,794	+ 4,793	—	—	—	—	—
	Do. Western Extn.	211	30.11.35	901	+ 67	22	16,723	16,290	+ 433	—	—	—	—	—
	Cordoba Central	1,218	7.12.35	30,260	+ 790	23	707,830	694,900	+ 12,930	Ord. Inc.	6	3	2	Nil
	Costa Rica	188	Oct., 1935	11,634	– 2,012	17	55,349	63,485	– 8,136	Stk.	30 3/4	23 1/2	34	5 7/8
	Dorada	70	Oct., 1935	11,900	+ 200	43	117,400	102,400	+ 15,000	1 Mt. Db.	103	95	102 1/2	5 7/8
	Entre Rios	810	7.12.35	10,905	– 1,755	23	265,315	266,492	– 1,177	Ord. Stk.	21 1/2	12	10	Nil
	Great Western of Brazil ..	1,082	30.11.35	8,600	– 6,200	48	369,700	422,800	– 53,100	Ord. Sh.	7/8	5/8	1/2	Nil
	International of Cl. Amer.	794	Oct., 1935	$294,856	– $11,293	43	$3,844,110	$3,946,051	– $101,941	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	1/–	1/–	1/8	Nil
	La Guaira & Caracas ..	22 3/4	Nov., 1935	3,260	+ 175	48	41,145	39,150	+ 1,995	Stk.	12 3/4	7 5/8	8 1/2	Nil
	Leopoldina	1,918	7.12.35	19,159	+ 1,940	49	882,214	1,081,036	– 198,822	Ord. Stk.	14 5/8	7	6	Nil
	Mexican	483	7.12.35	$236,300	+ $3,100	23	$5,666,400	$5,132,700	+ $533,700	,,	3 1/4	1 1/2	3/4	Nil
	Midland of Uruguay ..	319	Nov., 1935	8,356	– 5,180	22	30,701	52,325	– 21,624	,,	1 1/2	1/2	1 1/2	Nil
	Nitrate	401	30.11.35	8,784	– 3,520	48	139,621	122,783	+ 16,838	Ord. Sh.	32 9/32	51/–	2 5/8	Nil
	Paraguay Central	274	30.11.35	$2,451,000	+ $1,446,000	22	$42,997,000	$21,346,000	+ $21,651,000	Pr. Li. Stk.	84	67	78 1/2	7 5/8
	Peruvian Corporation ..	1,059	Nov., 1935	76,125	+ 17,432	22	375,790	309,538	+ 66,252	Pref.	14 1/2	8	10	Nil
	Salvador	100	30.11.35	¢14,410	– ¢4,090	22	¢263,846	¢227,677	+ ¢36,169	Pr. Li. Db.	75	70	65	7 11 1
	San Paulo	1531/2	1.12.35	23,148	– 8,142	48	1,218,627	1,304,845	– 86,218	Ord. Stk.	86	67	44 1/2	5 5/8
	Taltal	164	Nov., 1935	4,005	+ 1,780	22	16,645	11,430	+ 5,215	Ord. Sh.	2 1/8	1 7/16	1 5/8	7 1/4
	United of Havana	1,353	7.12.35	13,596	+ 93	23	356,170	375,641	– 19,471	Ord. Stk.	6	2	2	Nil
	Uruguay Northern ..	73	Nov., 1935	1,106	– 216	22	3,633	5,766	– 2,133	Deb. Stk.	6 1/4	3	4 1/2	Nil
Canada.	Canadian National ..	23,688	30.11.35	916,765	+ 51,007	48	31,641,959	30,309,604	+ 1,332,355	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78 1/4	51 1/2	67 1/2§	5 15 16
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	104 1/2	97 1/4	99§	4 1/16
	Canadian Pacific	17,224	7.12.35	558,600	+ 36,400	49	24,178,000	23,489,600	+ 688,400	Ord. Stk.	18 5/16	11 1/16	11 1/2	Nil
India.†	Assam Bengal	1,329	20.11.35	38,947	– 238	33	785,151	901,951	– 116,800	Ord. Stk.	88 1/2	72	83 1/2	3 9/16
	Barsi Light	202	10.11.35	8,212	+ 3,712	32	86,812	87,720	– 908	Ord. Sh.	10 4 1/2	9 8 3/4	7 8 1/2	6 3/8
	Bengal & North Western ..	2,112	20.11.35	72,919	+ 3,335	8	326,521	316,308	+ 10,213	Ord. Stk.	297 1/2	262	299 1/2	5 5/16
	Bengal Dooars & Extension	161	10.11.35	4,571	– 507	32	84,950	95,994	– 11,044	,,	125 1/4	124	123 1/2	5 11 16
	Bengal-Nagpur	3,268	31.10.35	189,525	+ 19,982	30	3,674,515	3,371,255	+ 303,260	,,	105 1/2	96	101 1/2§	3 15 16
	Bombay, Baroda & Cl. India	3,072	30.11.35	244,875	+ 22,800	34	5,223,300	5,185,575	+ 37,725	,,	115	108 1/2	110 1/2§	5 7 16
	Madras&South'n Mahratta	3,230	10.11.35	132,750	+ 18,418	32	3,224,644	3,500,474	– 275,830	,,	131	122 3/4	115 1/2§	7 5/4
	Rohilkund & Kumaon ..	572	20.11.35	10,793	– 1,385	8	55,214	57,547	– 2,333	,,	263	250	293 1/2	5 7 16
	South India	2,526	20.11.35	91,741	– 12,887	33	2,548,936	2,686,796	– 137,860	,,	119	115	107 1/2	7
Various.	Beira-Umtali	204	Sept., 1935	59,616	– 3,871	52	769,888	651,264	+ 118,624	—	—	—	—	—
	Bilbao River & Cantabrian	15	Nov., 1935	1,900	+ 286	48	16,953	18,333	– 1,380	—	—	—	—	—
	Egyptian Delta	622	20.11.35	10,250	+ 2,016	33	154,551	149,246	+ 5,305	Prf. Sh.	21 5/16	15 1/4	15 1/4	5 11 16
	Great Southern of Spain ..	104	30.11.35	1,927	– 558	48	86,647	108,027	– 21,380	Inc. Deb.	4	3 1/2	3 1/2	Nil
	Kenya & Uganda	1,625	Oct., 1935	193,202	+ 28,246	43	2,002,143	1,859,872	+ 142,271	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50	33	37	9 7 16
	Mashonaland	913	Sept., 1935	106,693	– 7,903	52	1,384,055	1,191,218	+ 192,837	1 Mg. Db.	101	91 3/4	102	4 7/8
	Midland of W. Australia ..	277	Oct., 1935	17,060	+ 296	17	54,262	56,354	– 2,092	Inc. Deb.	100	93	94 1/2	5 5 16
	Nigerian	1,905	19.10.35	28,193	– 7,417	29	671,029	769,899	– 98,870	—	—	—	—	—
	Rhodesia	1,538	Sept., 1935	193,326	+ 10,016	52	2,319,058	1,992,128	+ 326,930	4 p.c. Db.	104 7/8	97 1/2	104	3 7/8
	South African	13,246	16.11.35	597,036	+ 54,230	33	18,434,005	16,724,305	+ 1,709,700	—	—	—	—	—
	Victorian	4,728	Aug., 1935	736,134	+ 4,008	9	1,449,523	1,433,140	+ 16,383	—	—	—	—	—
	Zafra & Huelva	112	Oct., 1935	12,687	– 1,072	42	114,122	116,325	– 2,203	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value

Electric Railway Traction

Steam Engines on Electrified Railways

SURPRISE is sometimes expressed that on electrified railways steam locomotives are still to be found performing certain duties. On the Southern Railway, for instance, goods, parcels and special trains from other lines are still handled by steam engines, and even the Continental boat train between Victoria and Newhaven harbour is steam worked. The Southern Railway possesses no electric locomotives, all its electric services being worked by multiple-unit trains, the shortest of which normally consists of three bogie coaches. The gaps in the third rail at the many and complicated junctions in the neighbourhood of London are so long as to prohibit the general use of anything shorter than a three-car train, although on certain outlying and clearly defined sections two-car trains are used. No risk of stalling can be taken under the onerous traffic conditions found on the Southern suburban system, and it is for this reason that electric locomotives cannot be used. To equip certain vehicles on non-multiple trains so as to feed the locomotive should it be out of contact with the third rail would entail equipping all the vehicles in the train with heavy cables and connections. That would be impracticable for goods trains, made up as they are of vehicles from other railways, and since it is necessary to retain steam locomotives for goods trains it would not be economical to introduce electric locomotives at all. In fact, the only solution at junctions would be to provide an overhead conductor system and equip the locomotives with pantographs to collect the current there, as well as shoes for use where the third rail is laid.

The Flashing of Traction Motors

A COMMON feature of the nose-suspended d.c. traction motor is flashing over at the brushes, more particularly at high motor speeds. One of the main causes of flashing is the interruption in the power supply by third-rail gaps or movement of the pantograph, or by wheel slip. A second cause is the jumping of the brushes from the commutator. In certain cases of flashing an increase of brush pressure has reduced the evil by preventing the brush leaving the face of the segments or by reducing the time the brush is away from the commutator, but, of course, with some increase in commutator wear. Mechanical vibrations of the motor, second class design or construction of the mechanical details, roughness of the commutator, or electrical phenomena all may produce brush jumping. As regards the last-named, the designer of a normal type of traction motor has not a great deal of latitude, for the main current is definitely fixed by the work to be done at any instant, but such factors as self-inductance, resistance of the circuit, and the damping effect of the motor frame cannot be altered to any appreciable extent for a given motor. Under certain conditions a lift extending over only two-thousandths of a second may be sufficient to cause flashing, whereas five times that amount may not produce a flash under other conditions with the same armature current. The reduction of flashing by such means as the introduction of air currents or a magnetic-blow effect does not seem to have enjoyed more than experimental applications in traction motors; nor have shields or other devices arranged to divert the flash and protect the vulnerable details, probably through the extremely restricted space available. Some relief may be afforded by mounting more than one brush on an arm, and if four brushes are used the lifting of one would mean simply that most of its current would be transferred to the other of similar polarity, with little extraneous effects. This might not be sufficient to eliminate flashing, but it helps to reduce it.

Signalling on the Glasgow Subway

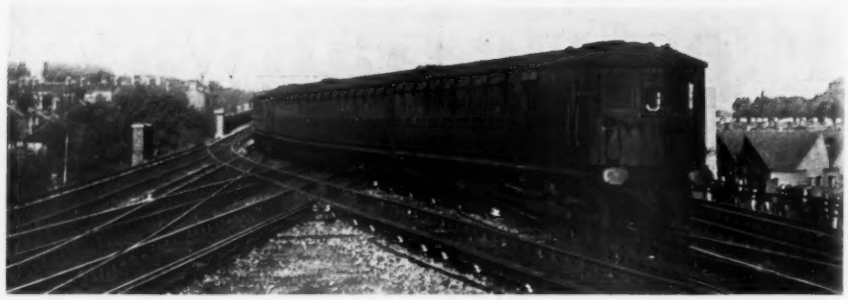
COINCIDENT with the conversion of the Glasgow Subway to full electric traction (described elsewhere in this issue), a change was made in the signalling system whereby the signals would be worked by the trains themselves and the traffic capacity of the line increased to the maximum possible. As every fourth sleeper (carrying the conductor rail brackets) is of steel, the use of ordinary track circuiting could not be adopted, but a solution was found in the use of the conductor wires along the sides of the tunnel which are used for the train lighting circuits. The use of these conductors for the signalling has the advantage that they are fed with a.c., which is preferable to d.c. in view of the heavy d.c. traction currents near the signal relays.

When a section is occupied by a train, the lighting current flowing to the train is used to operate a system of relays giving the proper signal indication. When there is no train in the section, no current is flowing and a "clear" aspect is given. At the beginning of each signalling section there is a treadle-operated contact, and the depression of this treadle puts the signal behind it to "stop." Protection is thus assured even if a train runs through a section with the lights extinguished. Before a train passes out of a section the lighting collectors pass over a short length of conductor rail known as the clearing section. This rail is connected to the section-clear relay system, and until this is operated by the passage of the shoes over the clearing section, the signalling section involved remains blocked. The possibility of a train passing a signal at "stop" is provided for by the installation of a train stop at each signal. Should a train pass a signal at "stop," the arm of the train stop engages the operating lever of the trip cock, and, through the action of the brake system to which it is connected, the power would be cut off and the train rapidly brought to a standstill. The signal relays are housed in the building which contains the traction switchgear. In the same building the varying aspects of the signals are shown on an indicator by means of coloured lenses. Visible indication is also given as to the functioning of the various signalling circuits and of the condition of the circuit breakers controlling the traction current.

XUM

RAILWAY ELECTRIFICATION IN 1935

A summary of a notable year's work



Suburban train running into Lewisham station from the newly-electrified Nunhead-Lewisham loop line, Southern Railway

CONTINUOUS activity in railway electrification has been a feature of the year 1935, and so far as actual mileage opened and authorised conversions to electric traction are concerned, it is well in advance of any previous year, and it is good to be able to record that Britain is well in the van of progress. The principal event to be recorded in a survey of the year's work is, for British interests, the opening of the Southern Railway extensions to Sevenoaks and Hastings, but taking the world as a whole the palm must go to the Pennsylvania Railroad, whose New York-Washington scheme, embracing the conversion of over 1,000 track miles, was completed early in the year; it forms the greatest electrification ever pushed through at one time.

The lines opened to electric traction by the Southern Railway totalled approximately 86 route and 188 track miles, all on the 650-volt d.c. system, and embraced the routes from Wivelsfield and Brighton to Lewes, Seaford, Eastbourne, Hastings and Ore; from Haywards Heath (Copyhold Junction) to Horsted Keynes; from Bickley Junction to Sevenoaks via Swanley, and from Orpington to Sevenoaks; the Nunhead-Lewisham loop; and the Woodside-Sanderstead branch. But these accomplishments are being dwarfed by the programme of future electrification announced in November, which covers the conversion of 252 route miles of line in the area east of the London-Portsmouth line, details of which were given in THE RAILWAY GAZETTE for November 8.

Accompanying this Southern Railway scheme for which Government financial guarantees have been given, are the conversion to the 1,500-volt d.c. system of the Manchester-Sheffield main line of the L.N.E.R., and the electrification on the 650-volt d.c. system of certain L.M.S.R. lines in the Wirral peninsula. Further north, the L.N.E.R. is busy electrifying the short branch from Newcastle to South Shields, which carries a heavy suburban traffic. At long last something definite matured regarding the conversion of the L.N.E.R. suburban lines out of Liverpool Street station, and the Loughton line and Barkingside loop are scheduled for electrification, as well as the old G.E.R. main line out to Shenfield. At the same time, a new tube is to be laid between Liverpool Street and Stratford, and possibly another will be driven from Leytonstone to Newbury Park, while the Finsbury Park-Edgware line of the old G.N.R. system will be electrified in order that London Passenger Transport Board trains may run over it. The L.P.T.B. announced its intention of electrifying the old Metropolitan line from Rickmansworth to Amersham; quadrupling the existing electric line from Harrow to Rickmansworth; and building a new tube

One of the new four-car express electric trains on the 3,000-volt d.c. line of the Belgian National Railways between Brussels and Antwerp

Cardano hydro-electric generating station, which supplies energy to some of the electric railways in the north of Italy

from Baker Street to West Hampstead to relieve the present double-tracked Metropolitan line.

Actual openings of electric lines in France have been confined to the system of the P.O.-Midi, but they do not lack anything in importance, for they include the 186-mile double-track main line from Vierzon to Brive, and the 167-mile double-track extension of the same route from Montauban to Narbonne and Sete. The intervening Brive-Montauban division will be converted by the end of 1936. The traffic density per route-km. over the Vierzon-Brive section amounts to 9,000,000 trailing tonne-km. a year. On the Etat, rapid progress is being made in the conversion of the Paris-Le Mans line west of Rambouillet, but east of that town the extensive civil engineering works must be completed before the electrical equipment can be erected. Another work proceeding on the Etat is the extension of the suburban electrification from Bois-Colombes to Argenteuil.

An important European extension was that of the Reichsbahn's Bavarian electrified system from Augsburg to Nuremberg the cost of conversion amounting to RM. 21,350,000 plus RM. 13,000,000 for new rolling stock. Between the opening of this line in May and the end of the year, it was announced that the Reichsbahn had been authorised to electrify the line from Nuremberg to Halle and its off-shoot from Corbetha to Leipzig, a total route mileage of 220. This will form a big stage in the eventual electrification of the whole of the trunk route from Berlin to

One of five lightweight 15,000-volt single-phase motor-coaches which have been built by Swiss firms for the Berne-Lotschberg-Simplon Railway

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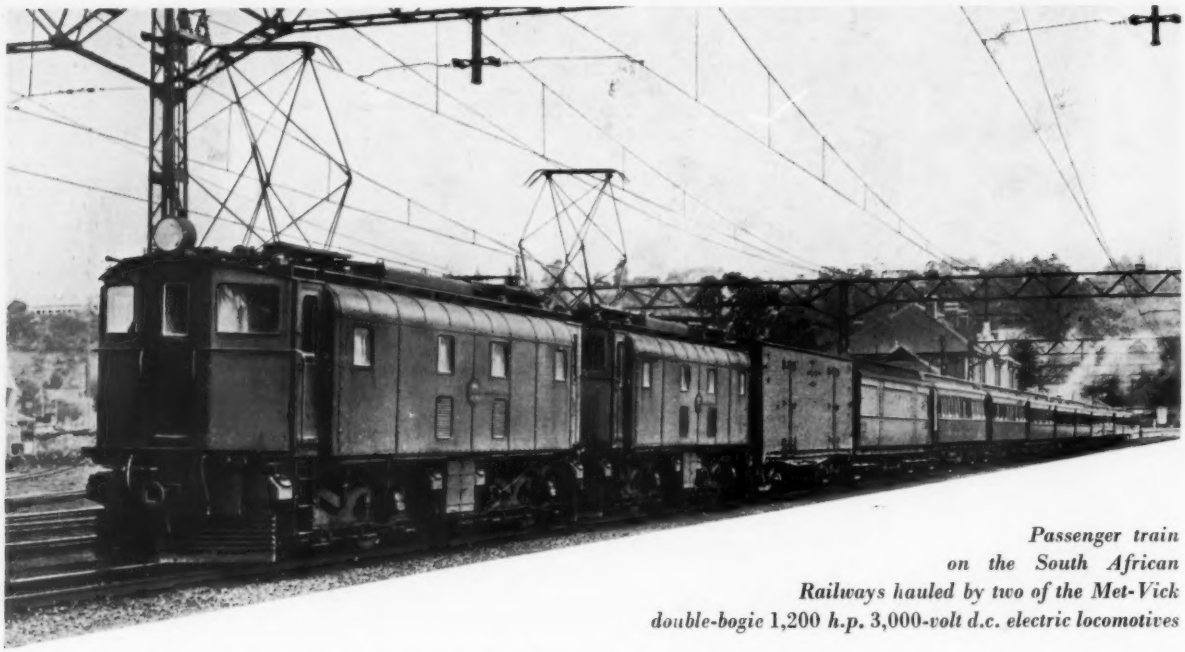


Passenger train on the South African Railways hauled by two of the Met-Vick double-bogie 1,200 h.p. 3,000-volt d.c. electric locomotives

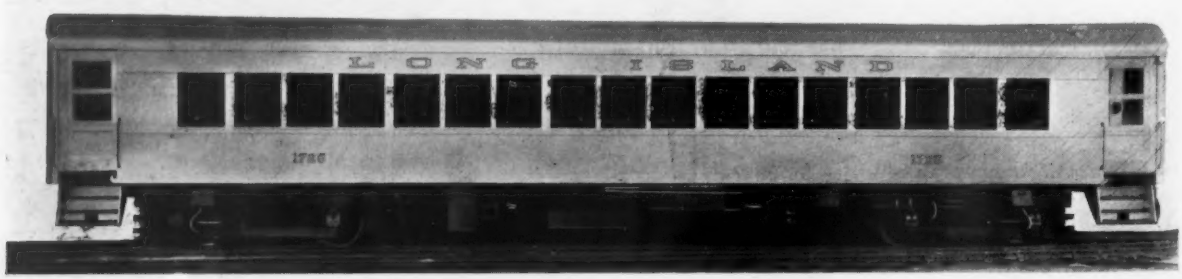
Munich, the only remaining section of which is that from Halle to Berlin.

Of special interest was the conversion of the Brussels-Antwerp line of the Belgian State Railways, which, by providing an express electric service of over 60 trains a day in each direction, doing the 27¼ miles in 30-33 min., has increased the traffic by about 20 per cent. and the number of season-ticket holders by 12 per cent., despite the peculiarity that steam trains are retained to serve the local stations *en route*. Multiple-unit trains only are used, and this remark also applies to the electrified section of the Netherlands Railways, which has been increased during the year by the conversion of the Rotterdam-Hook of Holland and Haarlem-Zandvoort lines. The general electrification of the Swiss Federal lines was treated to a brief respite, for no steam-worked lines were converted during the year.

Greatest Continental activity was registered in Italy and Sweden, where several projects under way for two years or more came to maturity. No fewer than 567 route miles of the Italian State Railways were opened to electric traction, mostly on the 3,000-volt d.c. principle, but partly on the 3,700-volt three-phase system, this great extension including the Florence-Rome-Naples main line. In Sweden, the Stockholm-Upsala-Krylbo line was turned over to the standard 15 kV. single-phase traction at the beginning of the year and was followed by the Angelholm-Halmstad; Krylbo-Bollnäs; and Hässleholm-Veinge sections, a total route mileage of approximately 280. Elsewhere in Scandinavia, electrification was confined to a short extension of the Copenhagen suburban system and the opening of the Voss-Eide branch of the Norwegian State Railways.

Nothing of note occurred in Hungary, except the official opening of the Komarom-Hegyeshalom electrified section of the State Railways, a line which has been so operated on the Kando system since September, 1934. In Austria actual conversions were represented only by the south bank of the Tauern line, the technical features of which were described in the issue of this Supplement for July 26. Slow progress continues to be made with the conversion of the Warsaw suburban lines, and still slower advance with the Madrid-Avila line of the Norte, in Spain. In the U.S.S.R. the heavily-trafficked line in the Donbass between Debalzevo and Chaplino has been electrified, and one or two prolongations of small extent in the Urals have been finished.

Further afield, Africa has been put on the new-electrification map once more by the completion of the 60-mile Daimana-Harrismith line in the Union of South Africa in February last, and by the important extensions now under way on the South African Railways, which embrace the



Suburban motor-coach of the Long Island Railroad which has been painted with aluminium paint

One of the new 1,300 h.p. two-car high-speed welded steel trains built for the single-phase lines in Bavaria

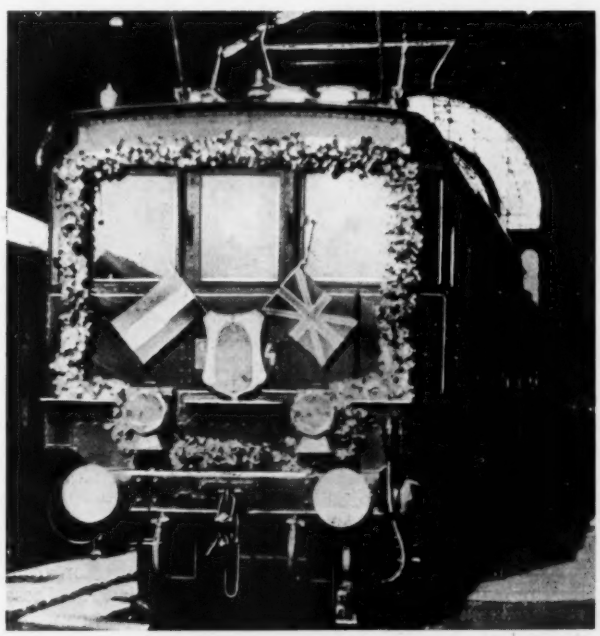
conversion of the main lines from Cato Ridge to Durban and from Glencoe to Volksrust, as well as 74 route-miles of lines round Johannesburg. A goodly proportion of this programme will be finished by the end of 1936. Other British Dominions with electrification programmes are New Zealand (Wellington-Paekakariki and Wellington-Johnsonville), and India (Borivli-Virar extension of the B.B.C.I.R. Bombay suburban lines). Electrification has been definitely recommended for the Colombo-Panadura broad-gauge line of the Ceylon Government Railways, but so far nothing has been authorised.

Of particular interest in British circles was the conclusion of the protracted negotiations between the Brazilian Government and the Metropolitan-Vickers Electrical Co. Ltd. for the electrification of the Rio suburban and the Rio-Barra do Pirahy main lines of the Central Railway of Brazil, at an estimated cost of £3,000,000 for the conversion to the 3,000-volt d.c. system of 91·5 route and 207 track miles of 5 ft. 3 in. gauge line. Remotely-controlled rectifier substations are to be a feature of the electrification, and track circuits and colour-light signals are to be installed throughout.

Extending to something like 310 route and 1,030 track miles, the conversion of the Pennsylvania Railroad's New York to Washington main line, and those of the dependent branch lines and yards which were not already electrified, is the biggest single conversion scheme in the history of railways. It has been carried through largely with the financial assistance of the Public Works Administration (to the extent of $80,000,000), but the idea was conceived, the details worked out, and conversion begun, before the public works schemes for finding employment were thought of. Both passenger and freight trains are operated, and the service includes 191 through and 448 other passenger trains, and 47 through freight trains. Approximately 10,030,000,000 trailing short-ton miles a year of freight train operation are being worked electrically, the locomotive mileage (freight and passenger) being about 18,000,000. Great accelerations of the through New York-Washington passenger trains have been made, and one train now does the 224·8 miles in 225 min., and a number of trains make the journey in 237 to 245 min. including stops. The electrification is on the standard Pennsylvania 11,000-volt single-phase 25-cycle system.

Rolling Stock

New electric motive power units set to work in England during 1935 were confined to the suburban-type and express trains required for the Southern Railway extensions, the most notable being the six-car buffet trains for the fast trains to Eastbourne and Hastings. In France, the delivery of the 25 4,000 h.p. 2-Do-2 express locomotives ordered some two-and-a-half years ago by the P.O. Rail-



Train at the official opening ceremony of the Komarom-Hegyeshalom section of the Hungarian State Railways. The electrical equipment of the locomotive was built by Met-Vick

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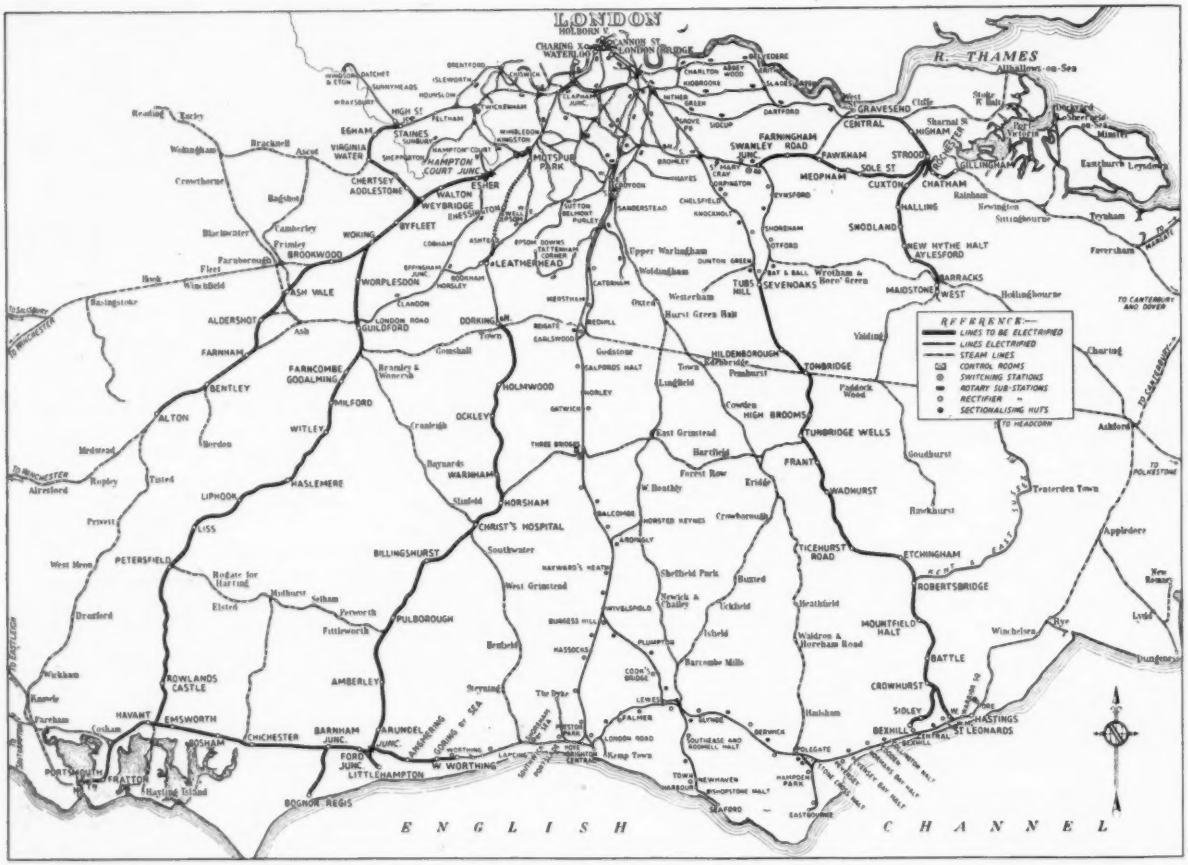
way was completed, and these machines are now working over the Paris-Brive division. Between Montauban and Sete all traffic is handled by Bo-Bo locomotives. Fifteen electric motor-coaches are now being delivered to the P.O.-Midi Railway for operation on secondary services, and the Etat has ordered 20 two-car stainless steel trains for working a fast suburban service from Paris (Montparnasse) to Rambouillet on the Le Mans line. For the main line trains, 2-Do-2 locomotives of 4,000 h.p. weighing 135 tonnes, and similar to the well-known P.O. machines, are being built.

Streamlined non-articulated (but close-coupled) two-car trains and glass-roofed observation motor-coaches for solo operation were the principal innovations on the German electric railway in Belgium apart from the Vicinaux lines, and in Holland a departure from normal practice was made by the introduction of two-car streamlined electric trains on the Amsterdam-Rotterdam-Hook lines. The Italian and Swedish railways perpetuated their existing standard designs, but the Italians also placed orders for streamlined three-car trains and single coaches. For the South African Railways, Met-Vick constructed, or are busy constructing, 25 double-bogie electric locomotives similar in design to the 95 units already in service, except that Timken roller bearing axleboxes are fitted, a new control gear layout adopted, and resilient gear wheels incorporated. The bodies of 72 electric motor-coaches for the Johannesburg lines are being built in this country by the Metro-



Map showing the existing electrified section of the Southern Railway and the extensive additional mileage which, according to proposals made in November, 1935, are to be converted within the next few years

single-phase lines during the year. The high-speed sets are suitable for a top speed of 100 m.p.h., and the motor capacity is 1,300 h.p. Welded steel bodies are used, and carry second class passengers only, but similar cars having a gear ratio suitable for a maximum speed of 75 m.p.h. have been built also, and seat second and third class passengers. The greater tractive effort of the second type of train is sufficient to accelerate the train from rest to 75 m.p.h. in 80 sec. on the straight level. These trains were built by the Maschinenfabrik Esslingen and the M.A.N.

In Belgium, in addition to the four-car Brussels-Antwerp sets, two 1,000 h.p. goods locomotives were built by A.C.E.C. for the Brussels-Tervueren Railway, the first politan-Cammell Carriage & Wagon Co. Ltd. and the Birmingham Railway Carriage & Wagon Co. Ltd. The electrical equipment is being supplied by the International G.E.C., of the U.S.A.

The first batch of the 57 streamlined electric locomotives ordered by the Pennsylvania Railroad for the principal expresses between New York and Washington is in service, and the remainder are following rapidly. Reputed to cost $250,000 each, these locomotives have a rating of 4,620 h.p. and a starting tractive effort of about 73,000 lb. The total weight is 205 Engl. tons, and the total length 79 ft. 6 in. One of these units is reported to have reached a speed of 102 m.p.h. on the opening run in February.

GLASGOW SUBWAY ELECTRIFICATION COMPLETE

A PAPER on the electrification of the Glasgow Subway (the first part of which was described in the issue of this Supplement for December 14, 1934) was read before the Institution of Engineers and Shipbuilders in Scotland on December 3, by Mr. W. R. Bruce, the Subway Engineer to the Glasgow Corporation, which owns the line. Mr. Bruce began with a brief historical survey of the subway and an account of its 38 years of cable operation, and then dealt with features of its electrification. Some of the information given by Mr. Bruce on the last-named subject is reproduced below.

From the time the line was acquired by the Corporation of Glasgow in 1923 it has been worked at a loss, and although electrification offered prospects of operating economies and increased traffic, the cost of conversion had to be low in order to avoid heavy capital charges. The actual work of conversion had to be carried out without interrupting the cable service, and numerous preliminary trials had to be made during the early hours on Sundays.

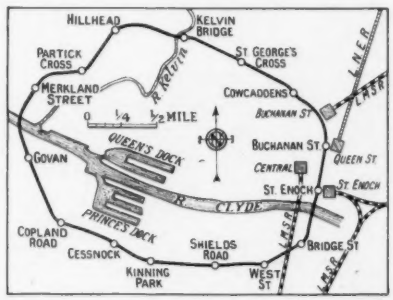
In the tunnels the entire track has been renewed. Not only have the rails been replaced by others of a heavier section, but the creosoted pine sleepers have been replaced by untreated hardwood sleepers; this substitution was necessitated by Ministry of Transport regulations. For the running track an 80-lb. flat bottom rail has been used. Such of the old 60-lb. rails as were serviceable have been used for the conductor rail, which is at the side of the track, and which, on account of space limitations, has had to be located at an inconveniently great height. To ensure the necessary rigidity in the conductor rail brackets, which overhang the ends of the sleepers to a considerable extent, steel sleepers have been incorporated at these points.

The running rails are used for the return current. In order to minimise the voltage drop special attention has been given to the bonding of all joints, and the two tracks are cross-bonded at intervals of 100 yd. In positions where a certain amount of vibration is unavoidable a type of flexible bond has been employed, and at other points solid bonds have been used; the cross section in each case is 6 S.W.G. The track has been laid in ballast except in the stations, where it is embedded in concrete. The rail gauge is 4 ft.

The power for the operation of the line is generated at the Transport Department's Pinkston power station at 6,000 volts a.c., and a 570-volt d.c. supply is given to the subway from three substations. Each subway station is equipped with a traction switchboard housed in a special building on the platform, and the switchboards are linked together by means of a ring-main cable.

The replacing of the existing vehicles with new stock having been ruled out on the score of cost, it followed that more adequate facilities would have to be provided if the proposed extensive rebuilding was to be carried out. The existing workshop facilities were sufficient for the purpose of ordinary maintenance repairs, but were inadequate for the execution of the rebuilding work. The enlargement of the workshops was therefore put in hand. Fortunately, the possibility of an extension to the car sheds had been foreseen, so that the necessity of acquiring ground did not arise. The workshops are situated immediately above the tunnels, and a pit in the floor of the building affords the only means of access thereto. When the rolling stock has to be transported from the tunnels to the car sheds, it is lifted bodily by a crane through this pit.

The coaches are of the double-bogie type, and a train consists of one motor-coach and one trailer. The cars are approximately 41 ft. long, with a vestibule at each end 4 ft. in length, and the greatest width is 7 ft. 8 in. The floors are level with the station platforms, which are 2 ft. 2 in. above rail level, and the headroom down the centre passage is 6 ft. 6 in. The seats run longitudinally, and are sub-divided by partitions or bulkheads. It was found that the bodywork of the old coaches was in excellent condition, due largely to the fact that they had been operating under cover. Extensive alterations, particularly to the underframe and bogies, were necessary, but the cost of new rolling stock would have been much greater. In order that clearance for the traction motors could be obtained without recourse to raising the floor level of the vehicles, a special underframe had to be designed, taking into account the effects of the higher speed of operation and the need for the suspension of an electrically-driven air compressor, together with sundry other apparatus necessary for the operation of electric rolling stock.



Map showing the location of the Glasgow subway which is now electrified

The cable-haulage type of bogie was found to be quite unsuitable for conversion, and a new bogie was designed. The wheel diameter of 27 in. could not be altered, but the wheelbase has been increased from 5 ft. to 5 ft. 6 in. to permit of the traction motors being hung inside. A current collector is fitted on each traction bogie. Owing to the height of the conductor rail above the running rail, the collector gear had to be of special design, and the arrangement takes the form of a hinged arm carrying a collector shoe. To the base of the collector gear are attached springs for maintaining the necessary pressure on the shoe; the collector shoe itself is free to turn through a small angle to maintain even contact on the conductor rail. On the leading bogie of each coach an air trip-cock is fitted, which is connected to the train pipe of the brake system, and on being operated brings the train automatically to a standstill.

Each motor-coach is equipped with four 60 h.p. fan-ventilated motors, two on each bogie. To enable the windings of the field coils and armatures to withstand the high running temperatures likely to result from 18 hr. continuous operation over a route on which heavy gradients are the rule rather than the exception, Class B insulating materials have been employed throughout. In the composition of insulating materials of this kind, asbestos is used to a great extent. Helical gearing, with a ratio of 14 to 61, transmits the power from the motors to the axles. Remote-control driving equipment has been

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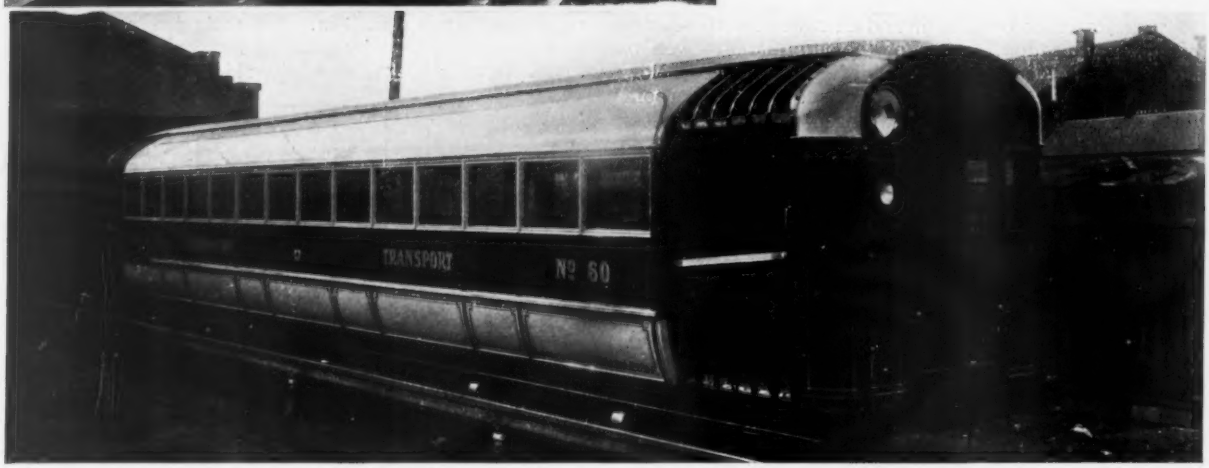
Left: Driving bogie for electric motor coaches running on 4-ft. gauge lines

Below: General view of one of the electric cars rebuilt from the old cable cars on the Glasgow Corporation subway



installed, the operation of which by the driver has been simplified through the incorporation of automatic acceleration devices whereby the master controller need not be operated notch by notch; one movement of the power handle is all that is necessary, and thereafter the rate of acceleration is governed by the setting of the acceleration relay. This method of control also takes account of the variation in starting conditions throughout the line. As the trains are always driven in the one direction, the line being circular, driving equipment on one end only has been fitted. The master controller incorporates the usual deadman handle.

Brakes working on the automatic principle are employed. Compressed air is used for the operation of the folding gates on each platform. By means of a push-button the conductor is able to operate all the gates throughout the train. The gate mechanism is interlocked with the driving controller, to prevent the premature starting of a train, and indicating lamps in the driving compartment keep the driver informed as to the condition of the gates. Two independent systems are used for the lighting of the coaches. The normal lighting is obtained from special lighting conductors mounted on the wall of the tunnels. Emergency lighting is obtained from the conductor rail. Special collector shoes mounted on the sides of the carriages make contact with the tunnel lighting conductors.

In the stations as originally constructed, timber was used extensively, particularly for platforms and staircases. As the use of wood in this way is contrary to the regulations for underground railways, all the platforms and staircases have been relaid with pre-cast concrete. At Hillhead station the entire upper works have been rebuilt, a large, commodious hall with an attractive entrance now takes the place of the old timbered station approach. At this level, accommodation is found for a booking office, lavatories, &c. A modern note has been struck in the general decorative treatment; the lower part of the walls has been finished with matt-glazed tiles set out in panels, while above the tiling the finishing is in cement plaster coloured in conformity with the motif adopted. Lighting has received special attention, and to supplement the booking facilities at rush hours, ticket-issuing machines have been installed.

Under cable haulage, economic and technical considerations placed a very definite limit to the maximum speed of operation. The haulage cable on the Glasgow subway travelled at a speed of 13½ m.p.h., and it was not possible to maintain a service with a schedule speed of more than 10 m.p.h. It is now intended to give an electric service with a schedule speed of 17 m.p.h. At this speed it will be possible to complete a circuit of the line in 23 min. against 38 min. with cable haulage. To begin with, the electrified service is being operated at a reduced speed, as it is not considered advisable to institute a full-speed schedule before the road bed has been thoroughly consolidated.

The Moscow Underground

The first section of the Moscow Underground, from Sokolniki to Smolenkskaia and from the Lenin Library to Krinskaia was opened in May last, and work on the remainder is being pushed forward. The technical features of the line were described in the issue of this Supplement for October 19, 1934. A different architect was employed for the design of each station and given almost a free hand as regards the style of the buildings. Some of the results are shown on the succeeding four pages. The stations are ventilated by air drawn in through air-shafts concealed in different parts of the city and in winter the air is warmed by electric heaters connected to the third rail. The standard fare for any journey is 25 kopecks.

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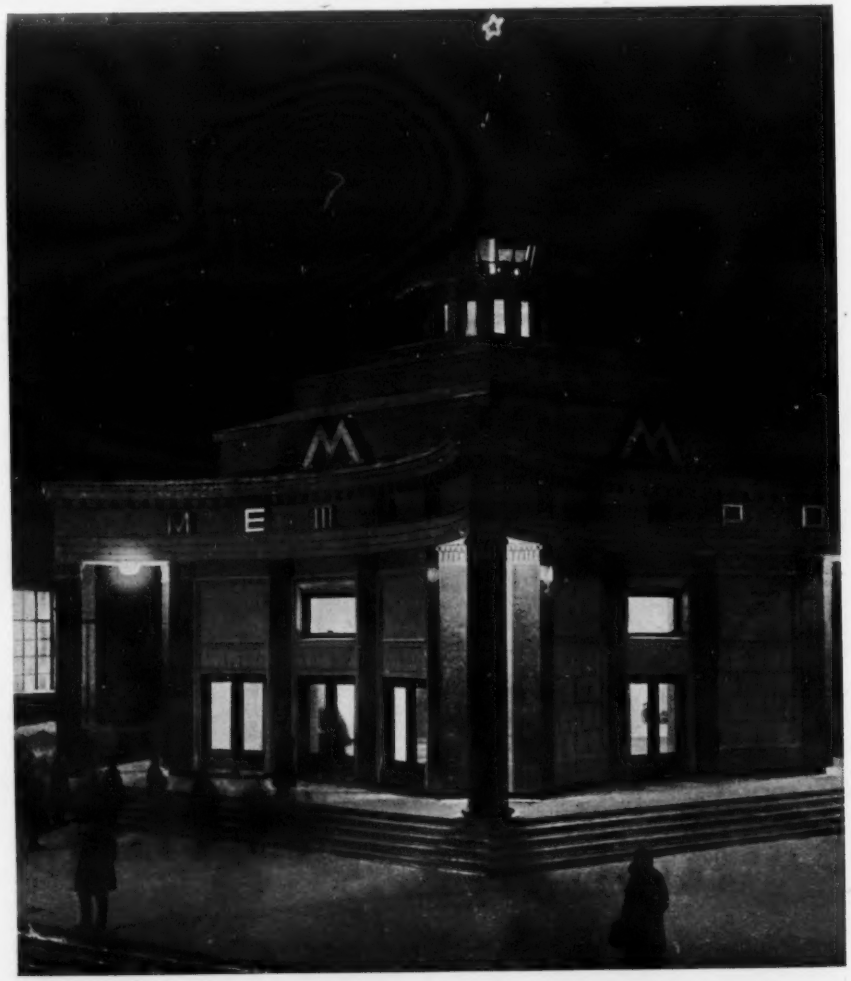
Entrance (left) and exit (right) corridors at Sokolniki station, the present northern terminus



A night view of the Arbatskaia Square Station

Staircase leading to platforms at Smolenskaia station, one of the southern termini of the Moscow underground railway

THE LATEST ARCHITECTURAL IDEAS HAVE BEEN EMBODIED IN THESE STATIONS ON THE MOSCOW UNDERGROUND

Komsomolskaia station

Above: The Lenin Library station. A view of one of the platforms

Left: The Kirovskaia station

EXTERIOR AND INTERIORS ON THE MOSCOW METRO

The Dzerzhinskovo Square station on the new Moscow underground railway

Exit stairway at Sokolniki station

FURTHER VIEWS ON THE MOSCOW UNDERGROUND

Circulating area between the platform faces of a large island platform at Okhotni Riad, one of the principal stations in the middle of Moscow

The Lenin Library station; the library is seen on the left

TWO UNDERGROUND STATIONS IN THE CENTRE OF MOSCOW